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CONTENTS.

Editorials ..... 339
A. I. E. E. Affairs ..... 342
Subscription to Lord Kelvin Memorial ..... 342
Program of Edison Convention ..... 342
Report of the House of Representatives Committee on Patents ..... 343
Oldfield Substitute Patent Bill ..... 344
Heavy Export Gains ..... 344
Answer of New York Edison Company to Rate Discrimination Charge 345
Massachusetts Workmen's Compensation Act ..... 346
Public Service Commission News ..... 347
Current News and Notes ..... 347
Enlargement of Texas Central Station ..... 349
High-Potential Cable Testing at Boston ..... 354
Raising the Standard of Cable Specifications. By Alden W. Welch .. 356
Singular Action of Lightning ..... 357
Frontage Charges in Ornamental Street Lighting ..... 358
Transforming a Double-Current Generator Into a Rotary Converter ... 358
Security of Electric Signs ..... 358
Central-Station Ice-Making. By H. J. MacIntire ..... 359
Artificial Granite Posts Cast in Position ..... 361
Disconnect Coupling for Oil-Switch Leads ..... 361
Wiring Old Houses.—IV. By Terrell Croft ..... 361
Apparatus for Measuring Light and Illumination. By J. S. Dow and V. H. MacKinney ..... 363
Recent Telephone Patents ..... 366

LETTER TO THE EDITORS:

Residence Rates. By E. C. Anderson ..... 366
Digest of Current Electrical Literature ..... 367
Book Reviews ..... 370
New Apparatus and Appliances ..... 371
Industrial and Financial News ..... 376
Weekly Record of Electrical Patents ..... 384

### EMPLOYERS' LIABILITY.

Few latter-day movements for improving the welfare of society have gathered impetus faster than the proposal to place the burden of industrial accidents where it rightly belongs, not on the employee, but on the industry which he serves. During the past few years the country has been aroused to the fact that the present employers' liability system is inequitable and wasteful. It is estimated that the total mortality from accidents in the United States, among adult wage earners, is between 30,000 and 35,000 annually, and the non-fatal accidents, about half of which occur in industrial works, approximate 2,000,000 yearly. This waste of human life and disregard of the misery and hardship which follow the maiming or disabling of industrial workers, and which the old liability law so inadequately relieves, is a serious indictment against our modern civilization.

The new workmen's compensation act in Massachusetts, abstracted elsewhere, is a model of its kind and worthy of emulation in other states. The need for such a progressive measure is now recognized alike by workmen and their employers. It marks the end of that iniquitous practice, heretofore common and unfortunately still persisted in, of withholding all relief except first aid until the injured worker signs a release waiving all legal claims upon his employer for damages or compensation. It also marks the definite arrival of a widespread use of safety appliances, for a few dollars' worth of protection will cost far less than the compensation of injured workmen. As part of the general conservation movement the Massachusetts act stands for definite achievement.

### OIL FUEL IN ELECTRICAL SERVICE.

As hydroelectric energy transmission systems rise year by year to greater prominence the problem of a suitable stand-by source of energy becomes of increasing importance. A stand-by station must above all else be equipped for immediate activity. A recent proposal worthy of serious consideration, based on experience in the Pacific Coast region, is one involving the combination of oil-fired boilers with a heat-storage supply of superheated water. The proposition, which owes its origin to Mr. A. M. Hunt, is to keep the storage tanks thoroughly heat-insulated with enough energy produced in electric heaters to replace the heat losses from radiation and convection. Valves connecting these storage tanks with the boiler supply operate automatically whenever the pressure in the boilers rises above that in the storage tanks, which normally are charged by the use of steam from the main boilers. With an oil supply controlled from a central point and automatic igniters oil fire can be started under all the boilers at once. The storage tanks

at a pinch are capable of operating the whole plant for thirty minutes, while the boilers are heating, and the steam is utilized in turbo-generators. A careful estimate of the costs as compared with a gas-engine installation shows that the cost of the emergency station as proposed would be less than half that of a gas-engine station and the stand-by charges also less than half. As to promptness of operation, this emergency plant seems to leave little to be desired, inasmuch as it should be ready for action within two minutes after a call for service.

In connection with the consideration of the advantageous features of oil as fuel for stand-by service, sight must not be lost of the highly important developments in prime movers of the oil-engine type. The oil engine did not meet with much success in this country until within the last two or three years, when the number of units increased considerably. Most of the plants thus far installed have been small, and certain mechanical difficulties have been encountered. However, the recent report of the prime movers committee of the National Electric Light Association shows that the thermal efficiency is high, the specific consumption being perhaps not above 0.5 lb. of oil per brake-hp-hour in actual service.

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**THE PATENT SITUATION.**

The report of the House of Representatives committee on patents, abstracted elsewhere in this issue, is of vital interest to the entire industry and demands careful study. Notwithstanding the large amount of testimony presented at the hearings and directed against the proposal to take away the patentee's right to fix the resale price and impose restrictions on the use of the patented article in connection with unpatented articles, the committee adheres to its commendable course in attempting to eliminate the evils which have grown up under these privileges. It appears to be sound policy to take the position that these restrictions ought to be subject only to such tests of legality as apply in the case of unpatented articles. This would render the violation of a contract for sale or use of a patented article no ground for an action for infringement, but merely a cause for suit under the general laws. The perversion of patents to purely commercial ends, without stimulating real invention or benefiting either inventors or the public, was perfectly apparent from much of the testimony presented. Articles on which the fundamental patents, if any, have long since expired are now covered by patents on mere trivialities which neither embody substantial merit nor carry control of the field, all for the purpose of restricting the sale or use. The endless and harmful possibilities of the restrictive privilege are made obvious in the report by several absurd but perfectly possible illustrations.

The proposal for compulsory license as now drawn appears to be inspired by a desire to protect the inventor as well as to prevent the suppression of competitive patents. Clearly the inventor will be secure so long as he retains his patent, and equally a company which buys the patent and works it will be secure. Whether or not the proposal is faultily constructed, the clear intent, which ought to control in cases of doubt, is to prevent the suppression of patents against the public interest. Even in the cases where a license can be obtained from an unwilling patent owner, both sides must be heard in court before the issue is decided, and reasonable compensation fixed. The proposal to limit the term of a patent to nineteen years from the date of filing application, with a maximum actual term of seventeen years, is aimed at the prevalent procrastination in pushing applications to issue.

In another column there is given also an abstract of the new bill accompanying the report, which is an amended substitute for the first Oldfield bill. Its provisions are explained at length in the report. Those sections which aim to bring combinations of competing patents under the Sherman act will require careful study. The report also contains references to other legislation which is needed both in relation to the law and its administration and the needed reforms in Patent Office procedure. A perusal of the report shows that the testimony of prominent inventors and the memorials presented by the Inventors' Guild carried much weight with the committee, facts which have hopeful significance in view of the mass of prejudiced and selfish arguments advanced at the hearings.

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**STANDARDIZATION OF NON-INSULATED CONDUCTOR WIRES.**

The introduction of very high voltages in electric power transmission, with its tendency toward tower supports for the line wires, makes the design and construction of such lines a matter requiring very careful consideration both from the mechanical and the electrical standpoint. This, in turn, calls for the standardization of line conductor sizes and properties, both nationally and internationally. The first step toward the international standardization of copper conductors is the adoption of an international basis of electrical resistivity and of the temperature coefficient of resistivity. To this end, we are informed that the international sub-committee on "rating" of the International Electrochemical Commission, which met at Paris last May and to which Mr. C. O. Mailloux was the United States delegate, has recommended to the commission that the value of resistivity proposed by the Bureau of Standards shall be made international; namely, that a copper wire having a length of 1 m and a weight of 1 gram at 20 deg. C. shall be 0.15328 international ohm, the absolute temperature of zero resistivity being inferred as —234.5 deg. C. This would be the standard resistivity of annealed copper wire. It would correspond to a conductance of exactly 58 mhos, in a wire 1 m long and 1 sq. mm in section, at 20 deg. C., and would also correspond to a volume resistivity of 1.5789 microhm-cm at 0 deg. C., the density of the copper being taken as 8.89 grams per cubic centimeter at 20 deg. C.

It is not to be supposed that there is much difference between the standards of resistivity, or between the copper wire tables, of different countries. Indeed, there is but little difference between them. Nevertheless, unless actually the same numerical standards are used throughout, confusion and misunderstanding are sure to occur between electrical engineers of different countries, since, in the exchange of ideas at long range, small numerical differences are likely to subtend relatively large psychological dimensions. In an article recently published in the *Elektro-*

*technische Zeitschrift,* and referred to in this week's *Digest,* Mr. W. von Moellendorff calls attention to the differences between the demands of different customers in specifications for hard-drawn conductors. He shows that such wide differences apparently are not justified by practical needs and constitute an unnecessary hardship in manufacture, so that marked advantage would accrue to the industry if the dimensions and properties of overhead-line conductors were standardized.

The suggestions in the article are very practical and might well commend themselves to the industry. They relate to the sizes of wires in standard use, the limits of permissible variation in their diameters, the sizes and composition of stranded conductors, the mechanical loads that each size should bear and the electrical conductivities. The article also recapitulates three well-known facts that observation has established in regard to copper wires—first, that the conductivity is always highest in electrolytically pure copper, rapidly falling off with impurity; second, that the admixture of impurities, or of alloys, with copper may increase the tensile strength materially but at a relatively greater loss in conductivity; third, that ingredients which increase the toughness generally reduce the tensile strength, and conversely. Nevertheless, there is always hope that some new alloy, or method of treatment, may bring about an exception to these rules.

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## STANDARD TESTS OF DRY CELLS.

Excepting incandescent lamps there is, perhaps, no electrical device so extensively used by the public at large as the dry cell. Dry cells are used for bell ringing, for ignition in gas engines, for magneto-telephone sets and for a host of minor purposes. Nevertheless, in spite of the large amount of general experience with dry cells, they are one of the hardest of electrical devices for which to provide a standard test. One reason for this peculiar state of affairs is that a dry cell is neither capable of supplying nor intended to supply steadily its maximum initial power output. A cell which has an internal emf of 1.5 volts and an internal resistance of 0.05 ohm—values very generally met with in practice—is able to give initially, and externally, 11.25 watts to a suitably selected load. If it could maintain this power until it was completely exhausted, it would only be a matter of a few hours' test to empty a dry cell of its energy and to measure the output. But no ordinary dry cell can be expected to maintain so high an output, which would correspond to lifting its own weight nearly 4 ft. per second against sea-level gravitation. Ordinary dry cells are designed only to be used for intermittent service. Then the question at once poses itself, How intermittent is the service test to be? To this question no single answer can be expected, because the degrees of severity and of intermittency in different kinds of dry-cell service differ so widely. The best that can be done is to agree conventionally upon a particular schedule of severity and intermittency of load, as representative of, say, ignition or telephone or bell-ringing requirements, and to test a number of cells under such schedules, so as to obtain an average. The testing process is naturally long and tedious. It is not at all adapted to the needs of the individual user of dry cells. Manufacturers and large-consumption purchasers can and do apply such tests; but the man who has to buy a few cells at retail must depend upon quickly made measurements, if he has time and apparatus to make measurements at all.

The subject of such tests was considered in a paper which was read at the last convention of the American Electrochemical Society as a report from a committee on dry-cell tests. It is shown that there are actually only two tests that can be applied promptly to a dry cell in order to obtain information as to its condition. One is to measure the internal emf at no-load, and the other is to measure the momentary short-circuit current, or the current instantaneously supplied by the cell through a low-resistance ammeter, with short leads. These measurements can be made in a few seconds with a combination direct-current volt-ammeter. Although not highly significant in themselves, yet, in conjunction with the known conditions concerning good new cells, these observations are capable of indicating whether the cell tested is in proper condition. The short-circuit test with the ammeter is, of the two, the more important single test that can be made. Modern dry cells commonly give from 15 amp to 30 amp, according to type, when tested in this way. In a paper read at the same convention by Mr. C. Hambuechen it was pointed out that makers of dry cells had in recent years steadily raised the initial short-circuit current of their various types, probably under the stimulus of these short-circuit tests. In fact, there is a danger of sacrificing cell durability or "shelf-wear" to the demands for large short-circuit current. According to observations reported, the short-circuit current of an ordinary cell falls, by age on the shelf, to 50 per cent in twelve months or less, although the internal voltage does not ordinarly fall very much in that time.

It would be interesting to know just what are the conditions in a dry cell which cause its internal resistance to double in the course of a year of inaction. It is to be supposed that the moisture slowly escapes, and that any dry cell finally earns its name both inside and out. If that is actually the case, there ought to be some way of keeping the moisture sealed in. Very few researches in this direction have thus far been published. The London *Electrician* recently published a research made at the National Physical Laboratory upon the behavior of different makes of dry cell under different kinds of test. No less than seven different testing schedules were applied to each type of cell investigated. The conclusion reached from the British tests conforms to that of the committee on dry-cell tests already mentioned. It is to the effect that none of the schedules "can be relied upon to give even an approximation of the relative capacity of dry cells or of the output which may be obtained under working conditions." This means that the only positive method of testing a battery of dry cells under an assigned duty is to install the battery and see how long it lasts, which is another way of repeating the old proverb that "the test of the pudding is in the eating." Nevertheless, the National Physical Laboratory's tests brought out the fact that one particular make of cell had an output of 100 watt-hours under every condition of test tried, which was much in excess of that given by any other type of cell.

## A. I. E. E. AFFAIRS.

At the regular monthly meeting of the board of directors of the American Institute of Electrical Engineers held on Aug. 9 the business transacted related largely to the indorsement of President Ralph D. Mershon's selection of chairmen and members of the various Institute committees. The names of these committees and the chairmen appointed are as follows: Executive, Mr. Ralph D. Mershon; finance, Mr. Charles W. Stone; library, Dr. Samuel Sheldon; meetings and papers, Mr. Walter S. Rugg; editing, Mr. Lewis T. Robinson; board of examiners, Mr. H. S. Putnam; sections, Mr. Paul M. Lincoln; standards, Dr. A. E. Kennelly; code, Mr. Farley Osgood; law, Mr. Charles A. Terry; railway, Mr. Frank J. Sprague; educational, Prof. H. H. Norris; high-tension transmission, Mr. Percy H. Thomas; electric lighting, Mr. W. C. L. Eglin; telegraphy and telephony, Mr. S. G. McMeen; electrochemical, Prof. A. F. Ganz; power station, Mr. H. G. Stott; electrophysics, Dr. John B. Whitehead; public policy, Mr. Calvert Townley; historical museum, Mr. T. C. Martin; United States national committee of the International Electrotechnical Commission, Mr. C. O. Mailloux; code of principles of professional conduct, Mr. B. A. Behrend; indexing *Transactions*, Mr. G. I. Rhodes; relations of consulting engineers, Mr. Lewis B. Stillwell; patent, Mr. B. J. Arnold; sections participation, Mr. E. A. Baldwin; committee on revision of constitution, Mr. C. W. Stone; membership, Mr. H. Clyde Snook; badges, Mr. Charles W. Stone; outgoing president's testimonial, Mr. Walter S. Rugg; Joubert memorial, Mr. C. O. Mailloux.

The following representatives of the Institute were also appointed by President Mershon: On joint committee of engineering education, Prof. Charles F. Scott and Dr. Samuel Sheldon; advisory board of "American Year-Book," Mr. Edward Caldwell; committee of the American Electric Railway Association on joint use of poles, Messrs. Farley Osgood, Percy H. Thomas and F. B. H. Paine; delegate to Sixth Congress of the International Association for Testing Materials, Mr. C. E. Skinner, Pittsburgh, Pa.; joint conference committee of National Engineering Societies, Messrs. Calvert Townley and W. W. Freeman; electrical committee of the National Fire Protection Association, Mr. Farley Osgood; on council of American Association for the Advancement of Science, Profs. G. W. Pierce and W. S. Franklin.

The board elected from its own membership the following three members to serve upon the Edison medal committee for two years: Messrs. Farley Osgood, Walter S. Rugg and Charles E. Scribner. The board also confirmed the appointment by President Mershon of Mr. H. Ward Leonard, Mr. Robert T. Lozier and Dr. A. E. Kennelly as members of the Edison medal committee for terms of five years, and Mr. Richard N. Dyer for the term of one year, vice Prof. Charles E. Lucke, resigned.

The following local honorary secretaries, whose terms expired on July 31, 1912, were reappointed by vote of the board for the two years ending July 31, 1914: Mr. James S. Fitzmaurice, Perth, Australia; Mr. Horace Field Parshall, London, England; Prof. L. A. Herdt, Montreal, Quebec; Mr. William G. T. Goodman, Adelaide, South Australia; Prof. Robert J. Scott, Christ Church, New Zealand; Mr. Henry Graftio, St. Petersburg, Russia.

Secretary Hutchinson announced that arrangements have been made by the American Society for Testing Materials for a reception to be given on Monday evening, Sept. 2, in the Engineering Societies Building, to the delegates and ladies attending the Sixth Congress of the International Association for Testing Materials, in which the American Society of Mechanical Engineers, the American Institute of Mining Engineers and the American Institute of Electrical Engineers have been invited to co-operate. The board authorized the Institute's participation in this reception. The Institute will be represented upon the general reception committee by President Ralph D. Mershon and Messrs. C. O. Mailloux, John W. Lieb, Jr., Dr. Clayton H. Sharp and Dr. Samuel W. Stratton.

## A. I. E. E. KELVIN MEMORIAL FUND.

As noted in our issue of July 27, page 182, a general movement has been inaugurated to erect a memorial window in Westminster Abbey to the late Lord Kelvin, distinguished engineer and man of science. Under date of Aug. 9 a circular call for subscriptions was issued to the membership of the A. I. E. E. by Secretary F. L. Hutchinson, in behalf of the Institute representatives on the general committee. The total amount received will be transmitted to the treasurer of the general committee in London. Contributions for any amount will be acceptable, but it has been estimated that a requisite fund will be obtained if individual subscriptions do not exceed $10. The Institute representatives on the general committee bespeak a wide response to this opportunity of paying honor and respect to the memory of the great English scientist, who for many years was an honorary member of the A. I. E. E.

## PROGRAM OF EDISON CONVENTION.

As announced in the July 13 issue, the Association of Edison Illuminating Companies will hold its twenty-eighth annual convention at Hot Springs, Va., Sept. 10, 11 and 12. Among the reports to be presented are the following: Meters, by Mr. S. G. Rhodes, New York; electric heating, by Mr. M. E. Turner, Cleveland; National Electrical Code, by Mr. A. A. Pope, New York; incandescent lamps, by Mr. J. W. Lieb, Jr., New York; storage batteries, by Mr. William S. Yeager, Brooklyn; electric vehicles, by Mr. E. W. Lloyd, Chicago; high potential disturbances, by Mr. S. D. Sprong, Brooklyn, and steam turbines, by Mr. W. F. Wells, Brooklyn.

In addition to the address by the president, General George H. Harries, the following papers are scheduled for presentation: "Development of Meter-Testing Methods," by Mr. Frank F. Magalhaes, New York; "Uses of Electricity for Purposes of Irrigation," by Mr. C. H. Williams, Denver; "The Relations Between the Public and Public Utility Corporations," by Mr. H. M. Byllesby, Chicago; "Rates," by Mr. Arthur Williams, New York; "Future and Present of the Incandescent Lamp," by Mr. John W. Howell, Harrison; "Welfare Department of the Edison Electric Illuminating Company of Boston," by Mr. Herbert W. Moses, Boston; "Improvement in the Design of Large Reactors," by Mr. P. Torchio, New York; "Burning Oil Fuel as a Substitute for High-Tension Transmission," by Mr. F. H. Varney, San Francisco; "System Operator's Pilot Board and Substation Signaling System," by Mr. W. H. Lawrence, New York; "Continuity of Service," by Mr. S. D. Sprong, Brooklyn; "High-Tension Power Transmission in the West," by Mr. James H. Wise, San Francisco, and an address by Dr. Charles P. Steinmetz, Schenectady.

Supplementing the above, a representative of the Westinghouse company will present a paper, the subject of which it at present unannounced. Another representative will read a paper on "The New Rotary Converter for the New York Edison Company." The General Electric Company will submit a paper, and a representative of the Rochester Railway & Light Company will present a paper entitled: "Practical Results of Operating Electric Vehicle Garages by Central Stations." As usual the meetings will be held behind closed doors and only duly accredited representatives will be permitted to attend.

## REPORT OF THE HOUSE OF REPRESENTATIVES COMMITTEE ON PATENTS.

The outcome of the long hearings before the patent committee of the House of Representatives during the present year is an important and interesting report (No. 1161) presented to the House on Aug. 8, which recommends an amended substitute for the original Oldfield bill (H. R. 23,417), with the stipulation that other legislation will be presented later. This report is of vital concern to all who have any interest in the patent situation and deserves very careful study. Its length, twenty-four pages, prevents full reproduction here, but the most important features will be brought out. There is widespread dissatisfaction with our present patent laws, which have remained practically unchanged since 1870. Meanwhile fundamental changes have taken place in our industrial conditions, chief among which is the rapid growth of trusts and combinations whose business rests largely on patents.

The testimony heard at the twenty-seven public hearings was confined as far as possible to Sections 17 and 32 of the original bill, the consideration of other questions being reserved until later. Two primary causes of dissatisfaction were found: First, the abuses of the rights granted by patents, and, second, the defects in the present administration of the law in the Patent Office and the courts. No complete remedy is possible without removing these two great causes.

As a remedy it was proposed to take away the right to fix the resale price and the right (confirmed in the Dick case) to prohibit patented machines from being used otherwise than in connection with unpatented materials furnished by the vendor or licensor. When concerns which are, or naturally ought to be, owners of competing patents combine to dominate some branch of industry, any patent thus perverted from its original use becomes part of a trade monopoly. In general, monopolies are attended by the twin evils of extortionate price and an arrest of progress in that branch of industry, which are matters of common knowledge. The latter tendency is perhaps the more insidious of the two.

The new bill is intended primarily to bring all kinds of business involving patents under the Sherman anti-trust law. The proverbial procrastination on the part of applicants in pushing their claims through the Patent Office, thus effectively lengthening the term of monopoly or throwing out a dragnet to involve others in interference, is covered by the proposal to annul every patent nineteen years from the date of application, or sooner, the maximum term of any patent not exceeding seventeen years. This allows two years in which to present the merits of the claims. Notorious examples of abuse under the present system, drawing out the proceedings for years, are at hand in the cases of the well-known telephone and automobile patents.

The next recommendation is one for preventing the suppression of patents, which undoubtedly has been practised extensively in order to prevent competition. Instances are cited which have come to light in litigation before the federal courts. The famous paper-bag case* is also mentioned. Capital seeking to control any industry through patents proceeds to buy all those of any importance, uses a few and suppresses the remainder, thereby building up a far broader monopoly than any created by the patent statutes. The monopoly created by a patent is in one specific thing, but the monopoly acquired by the purchase of competing patents is on the whole industry. The compulsory license clause in Section 1 of the new bill is designed to cure this evil. The section has none of the drastic features of similar statutes in foreign countries, and neither does it provide for the forfeiture of the patent right. Non-use or suppression in order to justify granting of a license must be for the purpose or with the result of suppressing competition between the thing protected by the patent suppressed and some other article made and sold by the owner of the patent. The original inventor does not come within the scope of this clause unless he enters into a contract for the suppression of his invention. This section will not harm the inventor but will improve his condition by creating a market for his patent rights.

The train of evils which grows out of the right to impose restrictions on the use or resale of patented articles is treated at length in the report. The right to fix the resale price and impose restrictions on the use of patented articles was first sanctioned by the courts in the well-known button-fastener case. The reactionary decision of the Supreme Court in the recent Dick case served but to emphasize the evils of these practices. Obviously many burdensome and malicious restrictions may lawfully be imposed on the use or sale of patented articles under this decision. On this point the report says specifically: "The question is not what has been made but what use will be made of this newly declared privilege. It easily can be converted into a plausible justification of commercial practices that have been outlawed in every state in the Union." It should be borne in mind that Section 2 of the new bill does not impair the obligation of any contract whatever. It touches only one of the two possible remedies that a patent owner has for the breach of a contractual duty by the other party.

Section 3 of the new bill is intended merely to bring non-residents of the United States under the provisions of the law, so that a patent may not be suppressed through assignment to a resident of another country. Section 4 is intended specifically to prevent the use of patents to monopolize trade or commerce among the several states or with foreign nations. It has been undertaken in Section 5 of the new bill to enumerate the business practices in connection with patented articles which are harmless when performed by those engaged in competitive business but dangerous when resorted to by those engaged in restraining trade. The several clauses in Section 5 are aimed at specific practices which it is desirable to abolish, such as fixing prices, imposing restrictions upon use, purchasing patents for the purpose of suppressing them, practising discrimination in the sale of patented articles, and certain methods of unfair competition practised by the Standard Oil and Tobacco trusts.

The purpose of Section 6 is to provide temporary protection for those who, through the processes of monopolization, have become absolutely dependent upon an illegal trust for their business existence. The alleged position occupied by the United Shoe Machinery Company is cited as an illustration. The remaining sections are designed to bring trade-restraining monopolies which have been aided by combinations of patents clearly under the provisions of the Sherman anti-trust law to provide legal machinery whereby violations may be prosecuted without difficulty.

The report states that the new bill submitted will go far toward protecting the rights both of the inventor and the public, by opening competitive markets for inventions and restoring industrial freedom. Other remedies, however, are needed. In respect to the administration of the courts two vital changes are badly needed. First, it is very essential to correct the existing practice of taking testimony in patent cases. The methods of trial pursued in patent causes in Germany and in England are referred to as models for adoption in this country. Litigation which now consumes years would, through the methods of trial now used abroad, be disposed of within as many months and possibly in a few weeks. The taking of testimony before an examiner should be discontinued, and all cases should be tried in the presence of an able judge with power to exclude evidence or to enforce its production, thus abolishing that abuse of legal process which has become the scandal of patent practice.

*150 Fed. 741.

Adequate legal machinery will not be available until there is created a single Court of Patent Appeals as a substitute for the present Court of Appeals in the different circuits. Under the present system diametrically opposing decisions have been rendered in the different circuits. Vital changes are also necessary in the Patent Office; in particular there is a great waste of time and expense through interference proceedings, which prove a special hardship on the poor inventor. The present law rather places a premium on the withholding of an invention, whereas it should be clearly to the inventor's advantage to make prompt disclosure. Changes should also be made in the organization and equipment of the Patent Office in order to increase its efficiency. The officers and employees of the Patent Office should be afforded greater opportunities for promotion, distinction and adequate compensation. The committee states that it is not yet ready to submit a bill embodying recommendations on the questions not covered by the substitute bill, but will submit these at a later date.

## OLDFIELD SUBSTITUTE PATENT BILL.

On Aug. 8 Chairman Oldfield, of the House of Representatives committee on patents, introduced a report (No. 1161) on the revision of the patent laws recommending a substitute measure for the bill (H. R. 23,417, introduced April 16) which the committee has long had under consideration. Many public hearings were given on the first bill and tremendous opposition arose from manufacturers and corporations who are making use of patents to fix the resale price or otherwise restrict the use of patented articles in such a way as to build up monopolies and restrain trade. The more prominent features of the new bill were outlined in our issue of July 27, but are now presented more fully.

Section 4884 of the Revised Statutes is amended in a number of particulars, which apply exclusively to patents granted after the passage of the act. Every patent will expire nineteen years from the date of filing application, exclusive of the time consumed in the Patent Office or the courts in considering the application or where the application has been involved in interference. In no case will the patent be in force more than seventeen years. The District Court within whose jurisdiction the owner of a patent may reside will have authority to compel the grant of a license if the applicant therefor shall prove to the satisfaction of the court that the patented invention is being withheld or suppressed by the owner and if the applicant shall further prove that the patent in question was filed more than three years prior to the proceedings for obtaining the license. The court, in its discretion, may order the owner of the patent to grant a license to the applicant in such form and under such terms as to duration of license, amount of royalty and security for payment as seem just, provided that the original inventor, who has not obligated himself or empowered another person to suppress or withhold his invention, is exempt from this clause. Appeal from the order of the District Court may be taken to the Circuit Court of Appeals in the customary manner.

The proposed amendments to Section 4899 of the Revised Statutes comprise the second section of the bill. Every purchaser of a patented article shall have the right to use and vend to others for use the article purchased, without liability therefor. No one who purchases or leases a patented article shall be liable to an action for infringement of the patent because of any breach of contract. Furthermore, no person who obtains a license from the owner of the patent to make, use or sell the thing patented shall be liable to an action for infringement because of a breach of such license.

Under Section 3 it is provided that every applicant for a patent and every owner of a patent who is not resident within the United States shall, within three months after the filing of his application or after the passage of this act, designate some person residing in this country upon whom process or notice of proceeding brought under this act may be served. Notice of such designation must be filed in writing in the Patent Office.

Section 4 is aimed directly at monopolies or trusts which are alleged to have successfully restrained trade under the shelter of the patent laws without violating the Sherman anti-trust law. This section provides that no patent shall be used to restrain trade unreasonably or to monopolize any part of the trade or commerce among the several states or with foreign nations, except in the articles which embody the invention or discovery patented and only to the extent that they embody the invention or discovery. Any patent used in any manner contrary to these provisions may be condemned by such proceeding as the law provides for the forfeiture, seizure and condemnation of property imported into the United States contrary to law.

Under the provisions of Section 5 it is stipulated that whenever in any civil suit or proceeding brought under the provisions of the act approved July 2, 1890, entitled "An act to protect trade and commerce against unlawful restraints and monopolies," it shall appear that a combination in restraint of trade was entered into or exists and that any patent has been used in connection with such restraint, the restraint shall be considered unreasonable on its face. Section 5 names twelve specific acts which are declared to be unlawful and to constitute restraint of trade. This list of unlawful acts includes fixing the resale price, imposing restrictions on the sale or use, exercising discrimination to restrain competition, destroying competition by selling at a price at or below the cost of production and distribution, or attempting to prevent or restrain competition by the use of any unfair or oppressive means and methods, all in connection with patented articles.

The remaining eight sections of the bill are almost wholly legal in character, relating to procedure against violations of the act and bringing offenders within the scope of the Sherman law as regards monopolies in restraint of trade.

## HEAVY EXPORT GAINS.

The figures now available for June, 1912, show a very healthy condition of our electrical export trade for the month and for the fiscal year, with fair indications that 1912-13 will even "better what is done." The exports in June of heavy electrical machinery were a little less than last year's, June being $678,287 as compared with $825,091; but in electrical apparatus and instruments June this year reached $1,104,815 as compared with $884,839 a year ago.

It is, however, when we turn to the figures of the year that we get a long view and a clearer comprehension of the situation. A single order in one month, or a large order held over for a month or two, may easily distort the immediate statistics; but these anomalies and irregularities tend to get straightened out in the course of a whole year. And this is what happens, although in comparing year by year one has to be guarded. It is obvious that one large contract for hydroelectric apparatus in Mexico, or a lighting plant in Japan, or a trolley system in India, might swell unduly the figures of any particular year, and thus distort the facts. But when there is a steady gain extending over three or four years only one inference, and that hopeful, can be deduced.

The exports of electrical apparatus for the last three fiscal years, then, run thus: 1910, $8,694,132; 1911, $10,702,827; 1912, $11,724,499. There can surely be no mistaking such an indication as that. When we turn to heavy electrical machinery we find the growth of export trade almost equally good. The figures run thus: 1910, $6,048,-

263; 1911, $8,024,628; 1912, $8,444,863. It will be observed that the gains of 1911 over 1910 were greater than those of 1912 over 1911, but it would be difficult, we fancy, to maintain an increase of 25 per cent annually. We do get such gains in electrical development, but not over a long period nor over the whole industry. Combining the figures of each year, the gain made comes out even more handsomely as follows: 1910, $14,742,395; 1911, $18,727,455; 1912, $20,169,362. There is much comfort and encouragement in an export trade that has crossed the $20,000,000 line and is still climbing. There is also cheer in the fact that the largest gains are made not in the limited class of heavy goods but in the wide field of diversified, small apparatus. Evidently our minor goods are in demand, and our manufacturers are cultivating with fair assiduity a receptive market.

Only one other point of view need here be considered for the moment, namely, the nature of that market. Our best customers do not change much from year to year, but their demands vary. Obviously one would not expect Mexico, torn by internecine warfare, to buy very much just now; yet if she settled down under a stable government again her purchases would be heavy instead of falling off, as they have done lately. Canada is an exceedingly good customer and continues to share her prosperity with us. In 1912 she took about $5,500,000 worth, or over 25 per cent of the total. England and Europe buy some goods, but not so heavily as to make a very perceptible difference one way or the other. Our best markets are the British colonies and South America, but South Africa and the Far East are friendly and buy largely.

## FIRE AT JAMESTOWN (N. Y.) STREET RAILWAY COMPANY'S PLANT.

A fire which started from an unknown cause in the boiler house of the Jamestown (N. Y.) Street Railway Company's plant at 3:15 a. m. on Aug. 10 resulted in about $25,000 damage, principally in the boiler house, before it was put out. A portion of the company's auxiliary generating plant is contained in the boiler house. No damage was sustained by the boilers and steam line or by the main generating plant, which was protected by a fireproof wall. The steel and wood roof of the boiler house was entirely burned off. Owing to the damage to coal and ash conveyors, mechanical stokers and blowers, the service was crippled somewhat, but by 7:30 a. m. the same day a number of cars were in operation, and by noon service was fully restored.

## COST OF DELAY IN GIVING SERVICE.

A recent report by the judiciary committee of the trustees of the Sanitary District of Chicago gives, in outline, an account of an episode of some interest growing out of an interruption of electric service by the Sanitary District, which supplies energy from the hydroelectric plant on the Chicago Drainage Canal. It appears that on July 27, 1910, the District entered into contract with the county commissioners to furnish electrical energy for a period of three years beginning Jan. 1, 1911, at a rate of 1.25 cents per kw-hr. For a reason not stated in the report the hydroelectric service was interrupted for a period of 126 days, at least so far as this particular customer was concerned, and the District did not furnish electricity under the contract until May 8, 1911.

By the terms of the contract the county commissioners had the right to purchase electricity elsewhere during interruptions, and accordingly they entered into contract with the Commonwealth Edison Company, which rendered bills for the service, amounting, after negotiations as to price, to $16,891.60, the adjusted rate being 4 cents per kw-hr. The commissioners held that the Sanitary District was responsible for this sum, but later offered to deduct the $5,278.62 which they would have paid the District if the latter had furnished the electricity. After this deduction the net loss was $11,612.98, and it was finally agreed that this should be borne in the proportion of 66-126ths by the county commissioners and 60-126ths by the District. This made the District's penalty $5,530.10. On recommendation of the committee that this was a reasonable settlement, the trustees of the Sanitary District passed an order directing the payment of $5,530.10 to the county commissioners, this payment to be made, however, at the same time that the commissioners paid their bills to the District up to June 1, 1912.

## ANSWER OF NEW YORK EDISON COMPANY TO RATE DISCRIMINATION CHARGE.

Nearly a year ago complaint was filed with the New York Public Service Commission for the First District, by several local organizations representing stationary engineers, that the New York Edison Company is unduly favoring large customers with low rates. The primary motive of the complainants appeared to be the desire to show that the Edison company is giving wholesale rates which bring in a return less than the cost of production, thereby competing unfairly with isolated plants and discriminating against small consumers.

Hearings have been held on numerous occasions to give the complainants opportunity to establish their case, and now the Edison company has filed with the commission a lengthy reply, which in several respects is a noteworthy discourse on the rate question as a whole. The full text of the reply is worth the careful study of all rate students.

The charge that discrimination between any two consumers is unreasonable, per se, is admirably disposed of by citations from several well-known rate cases. Of special interest is the discussion of the general principles underlying rate-making. The cost of supplying electrical energy is stated to consist largely of three elements, namely, fixed charges, customer or standby charges, and operating expenses or running costs, in accordance with the view generally accepted by rate experts. But the calculation of the cost of supplying a given customer is declared to be a hopeless task, although the cost of supplying a particular class may be approximated without great difficulty. Fourteen general principles are laid down as essential in preparing any rate schedule, which go to show that while the cost of service is an important consideration, it is not wholly controlling, and commercial expediency must always be consulted. Rule 8 brings this out forcibly: "It is not sufficient that a system of rates be theoretically sound. It must get and hold the business and be simple enough to be understandable by the consumer."

The former rates and the present rates, in effect since July 1, 1911, are presented in great detail, with explanations and arguments in justification. There are several schedules, known as the general rate, power rate, wholesale rate, automobile, storage battery and refrigeration rate, tunnel construction rate, breakdown service, high-tension service and New York City rate for aqueduct or tunnel construction. The maximum rate is 10 cents per kw-hr. and the minimum 3 cents.

In addition to the standard forms of contracts described, the company has on file with the commission a series of standard contract riders, which usually cover conveniences and facilities in the contract relations with customers, such as the rental of substation space in the consumer's building, for example. The city lighting contracts are not included, inasmuch as they are already on file.

In conclusion, the company states that it has consistently pursued a liberal and progressive policy in its relations with its customers and the public in the matter of both rates and service. It also claims that it has faithfully adhered to the broad principles laid down in its answer, on which the rate schedules are based, and claims that proper classifications and reasonable rates have been established without undue discrimination and without favoring any particular class of consumers. The company claims that it has treated its patrons fairly, justly and liberally and has voluntarily reduced its rates from time to time as fast as economies in the service and improvements in the art permit.

## MASSACHUSETTS WORKMEN'S COMPENSATION ACT.

Among the statutes of the several states that have thus far responded to the wide demand for improved employers' liability laws, there is none which affects employers of labor and their employees, and the dependents of the latter, in so comprehensive a degree as does the workmen's compensation act which became effective in Massachusetts on July 1. Legal rates of compensation for personal injury received by all employees in the State in the course of their employment, with the exception of farm laborers and domestic servants, are created by this act, which further provides a scale for payments to be made to the dependents of the employees covered by it when death results from personal injury so sustained. The new act has been formulated upon the basic principles that the expense of injuries incidental to industrial pursuits is a logical part of the cost of production, and that an employee should be compensated not upon the ground that an accident is the fault of the employer but because of the injury.

Administration of the workmen's compensation act, interpretation of its various sections and settlement by arbitration of all controversies arising between employer and employee under the act are vested in an industrial accident board created under the law. This board has five members appointed by the Governor for a term of five years, except in the case of the first board, which has one member appointed for one year, one for two years, one for three, one for four and one for five, their places being filled in rotation by the appointment each year of a new member who serves for the five-year term. In addition to its functions outlined above, the accident board is empowered to make various rules for carrying out the new act, and from the powers so granted, it is believed that the installation of safety devices will be made upon a very broad plane. Another of its provisions requires an employer to notify his employees, upon a form specified by the board, that he has accepted the provisions of the new act by insuring his liability under it either in any of the stock liability companies authorized to do business in the State of Massachusetts or in the Massachusetts Employees' Insurance Association, which is a mutual insurance body also created under the act, of which any employer may become a subscriber. Unless an employer becomes a subscriber to this new insurance association or holds a policy in one of the liability companies, by which he is also regarded as a "subscriber" within the meaning of the act, he loses the three great defenses at common law—that the employee was negligent, that the injury was caused through negligence of a fellow-workman, and that he had assumed the risk of injury—which have been the employer's haven of refuge in the past and as well the cause of much misery and hardship to dependents of wage-earners injured or killed in pursuit of their vocations.

An employee comes automatically within the provisions of the new act unless he gives written notice to his employer within certain defined periods on a form furnished by the Industrial Accident Board that he prefers to stand upon his common-law rights to recover damages in case of personal injury. In this event, however, the three common-law defenses mentioned above are retained by the employer who is a subscriber, and the possibility of the plaintiff's recovering damages are remote in time and certainty.

Payments under the new law will be made by the association to all injured employees or their dependents, excepting in cases where the injury is caused by the serious and wilful misconduct of the employee. If the man is injured through the serious misconduct of the employer, the amounts of compensation are to be doubled, and the extra compensation is to be paid to the association by the subscriber, who has the right to appear before the board and defend the claim for the extra compensation only. Three classes of benefit for disability are provided by the act. When an injury does not incapacitate for more than two weeks, medical and hospital services are furnished by the association when needed. When disability, although partial, lasts more than two weeks, the injured employee receives a weekly compensation, beginning on the fifteenth day after the injury, equal to one-half the difference between his average weekly wages before the injury and the average weekly wages he is able to earn thereafter, but not more than $10 per week is to be paid, nor is the total period covered by such payments to be more than 300 weeks. When disability is total, the association pays the injured employee a weekly compensation equal to one-half his average weekly wages before the injury, but not more than $10 or less than $4 per week, while the total period for such compensation is limited to 500 weeks and the amount to $3000.

In addition to the foregoing, special payments are provided by the law for the loss by severance of both hands at or above the wrist, or both feet at or above the ankle, or the loss of one hand and one foot, or the reduction to one-tenth of normal vision in both eyes, with eyeglasses. In these cases an extra compensation of one-half of the average weekly wages of the injured person, but not more than $10 or less than $4 a week, is to be paid for a period of 100 weeks. For the severance of either hand at or above the wrist, or either foot at or above the ankle, or the reduction to one-tenth the normal vision in either eye, with glasses, one-half of the weekly wages of the injured person is to be paid, the amount to be not more than $10 or less than $4 per week, for a period of fifty weeks. Several other additional payments in smaller amounts, for shorter periods and for certain minor accidents, resulting in the loss of toes and fingers, are also provided.

When an employee's death results from injury received in pursuit of his employment, the association pays to his survivors wholly dependent upon his earnings for support at the time of the injury a weekly payment equal to one-half his average weekly wages, but not more than $10 nor less than $4 a week, for a period of 300 weeks from the date of injury. If the employee leaves dependents who are only partly dependent upon his earnings for support at the time of his injury, the association pays to these a weekly compensation equal to the same proportion of the weekly payments to persons wholly dependent, as above, as the amount contributed by the employee to such partial dependents bears to the average weekly earnings of the deceased at the time of the injury. These payments are not to continue for more than 300 weeks from the date of injury.

If a subscriber to the insurance association who has complied with all of its rules, regulations and demands is required to pay damages to any employee on account of personal injuries, the association will pay the amount of the judgment and the costs thereof. The new insurance association is based upon the mutual plan. Each subscriber has one vote at any meeting, and if any subscriber has 500 employees to whom the association is bound to pay compensation, he is entitled to two votes, with one additional vote for each additional 500 employees. No subscriber is to have more than twenty votes.

For the purpose of financing the new association at the outset, the law authorizes the treasurer of the commonwealth to advance a maximum sum of $100,000 to the association on its four-year 4 per cent notes. The Industrial Accident Board intrusted with the administration of the new act hopes to obtain such improved relation between employer and employee that industrial accidents will be reduced, through this co-operation, to a minimum. The members of the first board are Messrs. Dudley M. Holman, David T. Dickinson, Edward F. McSweeney, Joseph A. Parks and James B. Carroll, chairman. The offices of the board are in the Pemberton Building, Pemberton Square, Boston, Mass.

## PUBLIC SERVICE COMMISSION NEWS.

### NEW YORK COMMISSION, FIRST DISTRICT.

The New York Edison Company has filed an extensive answer with the Public Service Commission, First District, replying to the discrimination charge which has been pending for nearly a year. The substance of this answer is given elsewhere in this issue.

### NEW YORK COMMISSION, SECOND DISTRICT.

The commission has authorized the Catskill Illuminating & Power Company, the Schoharie Light & Power Company and the Upper Hudson Electric Light & Railroad Company to consolidate and form a new corporation to be called the Upper Hudson Electric & Railroad Company. Before the consolidation is finally accomplished the Schoharie Light & Power Company is authorized to purchase the property of the Cairo Electric & Power Company. The matter of the consolidation of these properties has been before the commission for some time, during which a comprehensive investigation of the financial affairs and physical properties of the companies was made by the accounting and engineering experts of the commission. Before allowing the consolidation the commission required the wiping out of $180,000 of the capital stock. The total capital stock of the consolidated companies was $250,000, and that of the Cairo company $80,000. The authorized capital stock of the new corporation is $150,000. The company is authorized to issue $500,000 of 5 per cent thirty-year gold bonds to be sold at not less than 90, the proceeds to be used for canceling the entire obligations of the consolidating companies and to pay for legal and other expenses and improvements to plants. The total fixed capital of the new corporation is $246,000 less than that of the consolidated companies. Among the improvements planned are the building of a new substation at Tannersville, a new street-lighting system for Catskill and improvements to the steam plant, including two new boilers. Provision also has been made for a depreciation fund of $70,000. The consolidation of these companies will admit of tying the plants together by transmission lines and make the water-power available for all, with steam reserve. It is understood that the new company will be able to revise its rates, and some localities will be benefited by reductions. The companies consolidated serve the following localities: The villages of Catskill, Tannersville, Hunter, Athens and Coxsackie, the towns of Cairo, Hunter, Catskill, Coeymans and New Baltimore and the hamlets of Coeyman and Ravena.

The commission and its engineers have been in consultation with the representatives of Stone & Webster, who have charge of the Adirondack Power Corporation, to the end that the property may be put in first-class condition and further interruptions to service obviated. Financial and legal difficulties which have taken some time to adjust have delayed the working out of the plans as rapidly as expected. The company has already spent $75,000 and has plans for spending upward of $500,000 more. Numerous weak features of the plant have been corrected by the replacement of equipment, and the tailrace at Spier Falls is being dredged to increase the head about 5 ft. The gas plant at Oneida, which has been unsatisfactory, is to be remedied by the installation of a new holder with a capacity of 100,000 cu. ft., two new benches of sixes and a large amount of reinforcing and new street main. At present the company expects to have the system well in hand by the close of the summer, so that interruptions to service will be exceptional.

### MARYLAND COMMISSION.

Mr. W. Cabell Bruce, counsel to the Maryland Public Service Commission, has decided that a holding company may transfer its stock. Mr. Bruce so ruled in the application of the Hagerstown Light & Heat Company for permission to transfer its entire capital stock to the Northern Central Gas Company.

Mr. E. W. Bemis, the expert who is on the stand for the people in the hearing on the rates of the Consolidated Gas, Electric Light & Power Company of Baltimore, testified last week that, after allowing a 7 per cent return upon $6,942,000, his appraised value of the Consolidated's property, electrical energy could be sold to the retail consumer in Baltimore at 5.57 cents per kw-hr. instead of the present average price of 7.17 cents. The average price to all consumers is 3.64 cents per kw-hr. The actual cost to manufacture and distribute is 2.02 cents per kw-hr. Mr. Bemis allowed 0.246 cent per kw-hr. to cover depreciation, bringing the cost of energy to the company up to 2.27 cents. Allowing 7 per cent return upon the property value would add 0.89 cent, making a possible average price of 3.16 cents per kw-hr.

### MICHIGAN COMMISSION.

On Aug. 9 the commission authorized the consolidation of the Home Telephone Company of Detroit and its subsidiaries with the Michigan State Telephone Company. This was done by approving the opinion written by Commissioner Hemans, although at one time it was said that Chairman Glasgow would not sign the order unless several changes were made in it. The commission decided that it would be unnecessary to await the decision of the Supreme Court on the Giles law, as had been suggested, since it is not within its province to pass upon the constitutionality of measures and also because a clause in the order covers the matter.

# Current News and Notes

LONG-DISTANCE WIRELESS TRANSMISSION OVER LAND.—Interest in the recently established wireless communication between Lima, Peru, and Para, Brazil, centers not so much on the long distance of 3400 km (2100 miles) but on the height of the mountains between the two stations, namely, 6000 m (nearly 20,000 ft.). This performance establishes a new record in wireless telegraphy, in addition to bringing into immediate communication two places which have formerly been isolated from each other. The equipment employed is that of the Telefunken Wireless System.

* * *

GAS IGNITION BY LAMP BREAKAGES.—The Bureau of Mines has frequently been asked whether firedamp will be ignited by the fracture of an incandescent lamp bulb while the lamp is in operation. This question is of growing importance because of the increased use of low-voltage portable electric lamps employing tungsten filaments. Technical paper No. 23 just issued by the Bureau of Mines gives the results of 131 tests made for the purpose of throwing some light on the problem. Mixtures containing as little as 5 per cent of gas and others containing as high as 12.4 per cent of gas were ignited by 1½-cp, 3½-volt, 3/10-amp miniature lamps, which were smashed while operating at rated voltage. Out of the total of 131 tests, 78 caused ignition.

Iron and Steel Tariff.—As expected, President Taft vetoed the iron and steel tariff bill and returned it to Congress with his message on Aug. 15. Within three hours after receiving the veto the House passed the bill by more than the necessary two-thirds vote, and it was sent immediately to the Senate.

* * *

Indiana Public Utilities Bill.—The Indiana State Board of Agriculture recently adopted a resolution indorsing the movement for the passage of a public-utilities law and the creation of a commission. It is reported that a number of public-utility bills have been prepared for introduction at the coming session of the Legislature.

* * *

New York Double-Deck Car.—Bored and blasé New Yorkers were treated lately to that rare joy, a new sensation, when Broadway's first double-deck car made its maiden trip. Visitors from the prairie states must have been reminded of the "interurban" at home when they heard the screech of the whistle. This new stepless, center-door car has a seating capacity of eighty-eight, and eighty-three more can find standing room.

* * *

Salaries of Technical Graduates.—The following statistics have been compiled from recent returns from the graduates of the Massachusetts Institute of Technology, classes of 1907 and 1908. Although the returns for each class are not complete, the average annual salary of 106 members of the class of 1907 was $2,028, the lowest being $600 and the highest $6,000. The replies received from 139 members of the class of 1908 showed an average annual salary of $1,796 per annum, the lowest being $520 and the highest $5,200.

* * *

Proposed Public Service Commission in Illinois.—The Illinois Legislative Public Utilities Commission, which is the name of the legislative committee considering the proposal to establish a public-service commission in Illinois, Senator John Dailey, of Peoria, being chairman, will probably resume its hearings after the November election. At that time it is expected that several meetings will be held in Chicago, and it is believed that the commission will make its report, with the draft of such legislation as may be recommended, at the meeting of the General Assembly next January.

* * *

Service Statistics of New York Edison Company.—In the month of July the New York Edison Company installed 2147 additional meters, and during the last twelve months the gain in meter installations was 24,578. The net gain in industrial motor load during the same period was 45,851 hp, the gain during July aggregating 3222 hp. There are at present connected to the New York Edison Company's circuits 159,094 meters, and the load in 50-watt equivalents corrected for tungsten lamps is 10,704,859. This service is supplied from the Waterside stations and does not include any railway load.

* * *

New Use for Public Service Commissions.—A New York central-station company desiring to put twenty-five flat-rate customers on a meter basis and yet not incur their enmity apparently viewed the task with fear and trembling until the following solution presented itself. It requested the Public Service Commission, Second District, to "write a letter to us just as strong as you possibly can make it, showing in it the 'big stick' as much as you please, advising, crowding and perhaps ordering us to put our customers all upon meters and buy our current through a meter." Unfortunately, while the commission thought the change entirely proper it felt that this method of inviting unsolicited and gratuitous commendations of its work in the interests of the public could hardly be justified. Besides, it could not be oblivious of its dignity.

Specifications for Incandescent Lamps.—Circular No. 13, recently issued by the Bureau of Standards, contains standard specifications for incandescent electric lamps. No general conference of the lamp manufacturers and government engineers has been held since 1910, but the specifications and schedules were thoroughly revised in April and are now published in the fifth edition of this circular. The specifications cover lamps of the carbon, metallized, tantalum and tungsten-filament types. The bulletin contains the caution that only those thoroughly instructed in the art of lamp manufacture and the science of photometry should undertake to determine the acceptability of lamps under these specifications. Criticism and suggestions concerning the specifications and lamp ratings are invited from both manufacturers and users of lamps.

* * *

Pennsylvania Employers' Liability Act.—Under the Pennsylvania workmen's compensation act, the second draft of which has just been issued by the Industrial Accidents Commission for public criticism, the employer is held responsible for all accidents unless the workman is wilfully negligent. This is defined in the law as "reckless indifference to danger." In case an employee is permitted to hire another employee, the latter is entitled to all the benefits provided by the act as fully as he would be had he been hired directly by the employer. The rates of compensation specified are: For temporary and permanent total disability, 50 per cent of wages, but not more than $10 a week; for partial disability, the same until recovery; for loss of hand, 50 per cent during 175 weeks; for loss of arm or leg, 50 per cent during 215 weeks; for loss of foot, 50 per cent for 150 weeks, and for loss of eye, 50 per cent during 125 weeks. Special rates are provided for loss of both hands, arms, feet, legs or eyes. Membership in any organization from which he might receive benefits does not bar an employee from compensation under the act.

* * *

## SOCIETY MEETINGS.

International Association of Municipal Electricians.—Transportation arrangements are being completed for the convention of the International Association of Municipal Electricians at Peoria, Ill., Aug. 26-30, 1912. It is proposed that Eastern members take the Black Diamond Express on the Lehigh Valley Railroad on Sunday, Aug. 25, from New York and Philadelphia, arriving in Buffalo at 10:27 p. m. Eastern time, and leave there for Chicago by special sleeping car on the Lake Shore at 10:35 p. m. Eastern time, the rest of the trip to be made by special parlor car on the Rock Island, reaching Peoria at 6:25 p. m. It is planned to make the outgoing trip a part of the entertainment features of the convention. A rejuvenation of the Sons of Jove will be held during the convention.

* * *

Convention of Railway Electrical Engineers.—The fifth annual convention of the Association of Railway Electrical Engineers will be held in the Auditorium Hotel, Chicago, during the week of Monday, Oct. 21. During the convention there will be an exhibit of appliances on the ninth floor of the hotel, near the meeting-room of the association. The allied Railway Electric Supply Manufacturers' Association is making arrangements for the convention, the chairman of committees being as follows: Exhibits, Mr. W. F. Bauer; membership, Mr. J. Scribner; badges, Mr. G. H. Atkin; auditing, Mr. J. M. Lorenz; publicity, Mr. Edward Wray; speakers and entertainment, Mr. George H. Porter; reception and dance, Mr. W. M. Lalor; theaters, Mr. Otis B. Duncan; banquet, Mr. J. J. Schayer. The president of the manufacturers' association is Mr. Porter, of the Western Electric Company, and Mr. Scribner, of the Chicago office of the General Electric Company, is secretary.

# ENLARGEMENT OF TEXAS CENTRAL STATION

## Steam-Turbine Units Employed in the Development of the Existing Plant of the El Paso Electric Railway Company.

### Reconstruction and Co-ordination of Properties Effected Without Interruption to Lighting and Railway Service—Direct-Current Load Supplied Through Rotary Transforming Apparatus —Details of Steam Equipment.

A NEW and enlarged generating station for electric railway, lighting and industrial service has recently been completed by the Stone & Webster Engineering Corporation, of Boston, Mass., for the El Paso Electric Railway Company, one of the principal properties of Stone & Webster in the Texas district. The installation illustrates in a marked degree the advantages of steam-turbine units in connection with the development of existing plants where an extensive ground area is not required and furnishes an interesting example of an old and a new station which have been successfully co-ordinated in operation and in which continuous service has been maintained during the period of reconstruction.

GENERAL EQUIPMENT.

The plant is located about half a mile from the business center of El Paso, at the intersection of Santa Fé and Third Streets. The older portion occupies the southern end of the property, the newly completed section having been extended northward from the original plant. In general arrangement the station as completed consists of two boiler rooms laid out with parallel axes and two corresponding engine rooms, one containing direct-connected engines and vertical-type turbines of 2000-kw rating, with 1100 kw in rotary converter and motor-generator sets, and the other 4000 kw in horizontal-type turbines, various switchboard and auxiliary steam and electrical equipment being included in each part of the station. On the property outside the building are located two cooling towers, a water-softening plant, an oil house and coal-handling equipment. The plant generates direct-current energy for railway purposes at a pressure of 550 volts and current at 2300 volts, two-phase and 60 cycles, for lighting and motor service, the rotary-converter and motor-generator installations being utilized as a connecting link between the two classes of business and arranged so that the maximum efficiency can be obtained from the operation of each main generating unit. With the exception of one 200-kw, 575-volt generator in the old engine room, all primary generators in both portions of the plant supply current at 2300 volts alternating to the station buses. The railway service is normally supplied through the motor-generator sets and the rotary.

COAL HANDLING.

Coal is brought into the property by cars run upon a spur track of the Santa Fé, and is weighed by a 36-ft., 70-ton Howe railway track scale equipped with a registering beam which prints both gross and tare weights. The unloading of the coal from the cars and its subsequent rehandling are effected by a Browning steam-driven eight-wheel locomotive crane provided with double hoisting drums, a 1.5-cu. yd. clamshell bucket and a boom of sufficient length to permit operation at 40-ft. radius. Coal may also be unloaded into storage compartments having a combined capacity of 2200 tons with provision for expansion as the station is extended. When taken from storage or dis-

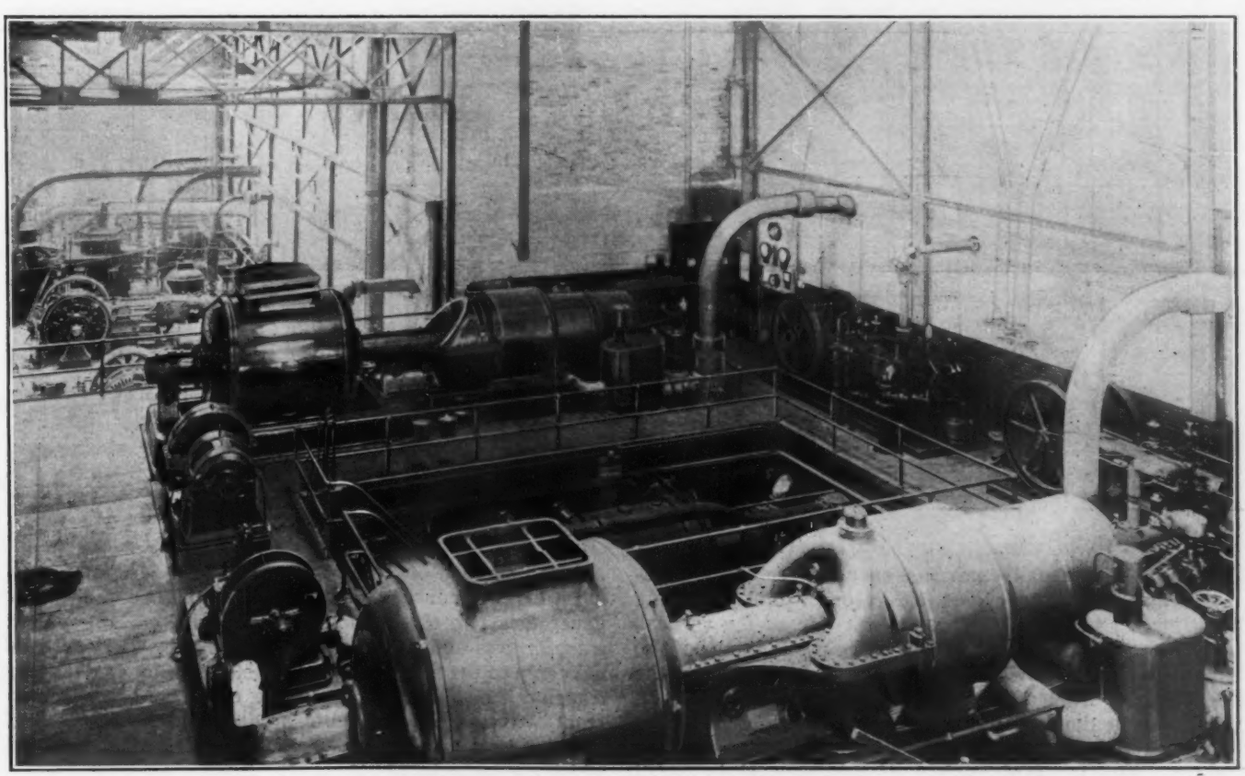


Fig. 1—New and Old Engine Rooms.

charged directly from the unloading bucket of the crane the fuel falls into a crusher and thence through another hopper and chute into the boot of an inclined continuous bucket elevator, whence it is carried up above the boiler room and delivered into the trough of a scraper conveyor located in the monitor of the building. A number of rack and pinion valves provided with hand-wheels and arranged

Fig. 2—Map of Properties.

to operate parallel to the trough enable the coal to be deposited in different sections of an overhead bunker installation. The coal-conveying equipment is capable of handling 50 tons per hour, and the coal crusher and each section of the conveyor are separately driven by induction motors.

Coal is taken from the bunkers as required through individual measuring devices provided for each boiler of the new portion of the station. In ordinary operation the fuel passes from the bunker through an auxiliary sliding gate valve to a rotative measuring chamber, which, on becoming full, is revolved by a chain wheel through a gear and pinion, the movement cutting off the coal supply at the same time that the charge is deposited in the hopper below. The coal thence falls into a stoker hopper. The coal-measuring device is provided with a socket joint permitting a maximum swing of 30 deg. to each side of the vertical, thus allowing coal to be spread over the whole length of the stoker hopper. Provision is also made for swinging the chute out in front of the boilers and adding an extension piece so that the fuel may be deposited on the floor. This enables the individual coal-measuring devices to be calibrated. The standard method of ash removal by small hand-cars operating on tracks in the boiler-room basement is used in this station. Ashes taken from the ash hoppers are carried to a pit located at the side of the coal-crusher pit, whence they are removed by the locomotive crane.

### BUILDING.

The new building is a steel-frame structure of brick and concrete supported on concrete foundations. The floors and roof are of concrete, and the permanent side walls are of brick with concrete door and window sills and trimmings. Temporary sides are of corrugated galvanized steel mounted on steel frames easily detachable for building extensions. The old portion of the station is a brick and steel structure with a low roof and is about 220 ft. square. The new section is about 220 ft. x 175 ft. in dimensions, having a floor area of about 8 sq. ft. per kw, present installation, compared with 24.2 sq. ft. per kw in the older portion. When extended, the new portion need only be increased in size a little to accommodate a large increase in generating equipment, while the old portion of the plant, which is now held mainly as a reserve, cannot be provided with any additional generating apparatus because of prohibitive cost, the units being small in number and considerably scattered.

### OLD PLANT

The older portion of the plant contains two 520-hp Babcock & Wilcox boilers, two 520-hp Aultman & Taylor boilers with Foster superheaters and three Stirling boilers rated at 350 hp each, with Stirling superheaters; three 500-kw, 2300-volt General Electric turbo-alternators with step-bearing pumps and accumulators; a 300-kw, 2300-volt alternator directly driven by a Ridgway engine; a 200-kw, 575-volt direct-current generator directly driven by a Ridgway engine; two motor-generator sets rated at 500 and 300 kw, each driven by a synchronous motor; a 300-kw rotary-converter for railway service, and various pumping and condensing apparatus, including a Deane low-level centrifugal condenser, three Knowles boiler-feed pumps, a Worthington 12-in. motor-driven vertical cooling tower, a hot-well pump, a boiler-washing pump, an 80-in. fan driven by a 20-hp induction motor for ventilating the turbo-generators, two 100-light and four 50-light constant-current transformers and a nine-panel switchboard. The fuel was delivered to the boiler room of the old plant by an overhead traveling hoist which dumped the coal upon the floor in front of the furnaces, hand firing being practised. The old plant is provided with a steel stack, the dimensions of which are 72 in. by 125 ft.

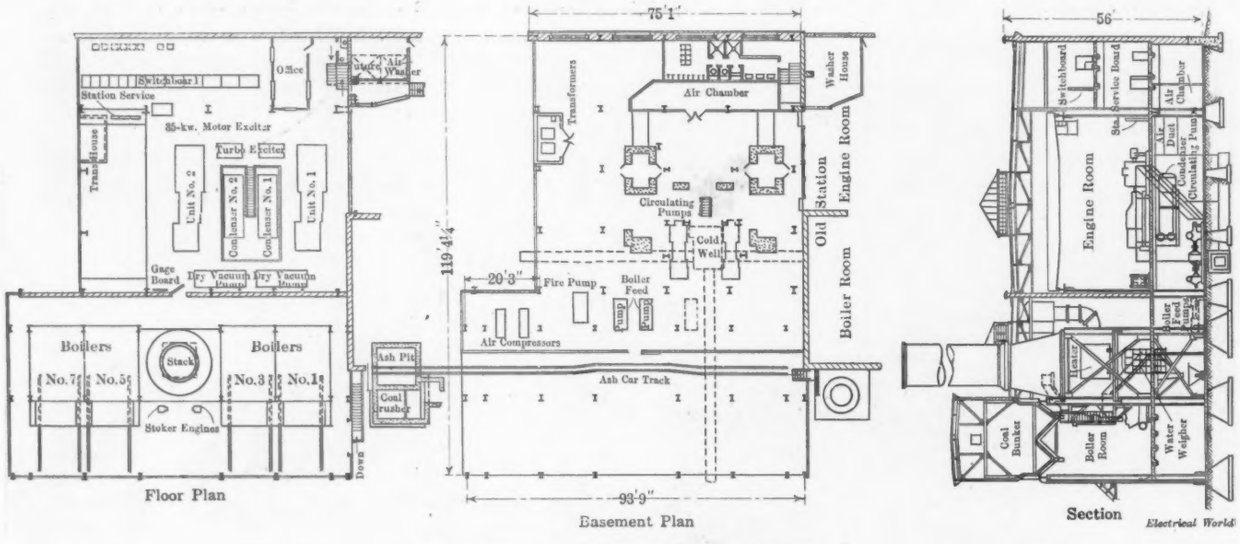



Fig. 3—Plans and Section of New Station.

NEW EQUIPMENT.

In the new section of the plant are located four 639-hp Babcock & Wilcox boilers and superheaters, each boiler being equipped with a 128-sq. ft. Greene chain-grate stoker; two 2000-kw, 2300-volt, two-phase Allis-Chalmers turbo-alternators; two 6000-sq. ft. Alberger surface condensers and auxiliary apparatus; a 5000-hp Webster feed-

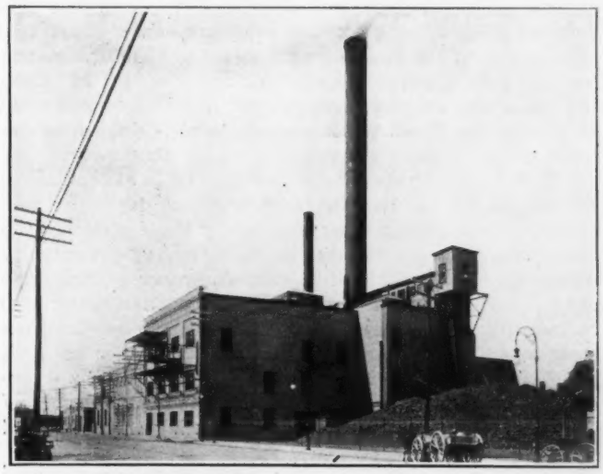


Fig. 4—Exterior of New and Old Plants.

water heater; a No. 8 Worthington liquid weigher of 250,000-lb. per hour rating; two 14-in. by 8.5-in. by 15-in. duplex boiler-feed pumps; two Sullivan steam-driven air compressors; a 20-ton, three-motor Case electric crane operated by 550-volt direct-current motors, and a 25-panel General Electric switchboard. A 4000-kw cooling tower is located in the yard outside the station, and the products of combustion are discharged by a steel stack 10 ft. 9 in. in diameter and 153 ft. high. In the ultimate extension of the station it is planned to arrange the boilers in two rows separated by a firing aisle, with centrally located overhead coal bunkers. In the engine room the turbines are placed parallel to each other and at right angles to the boiler room.

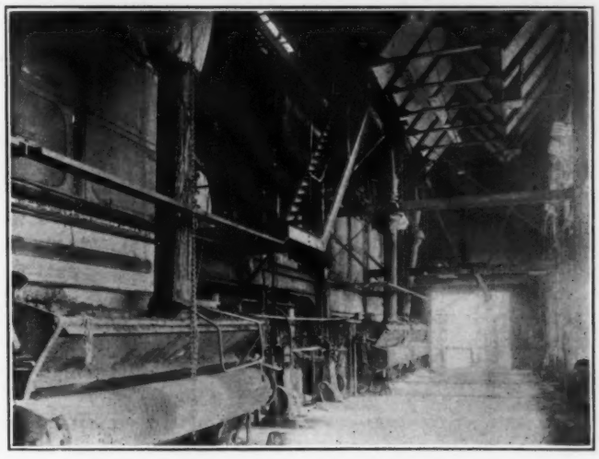


Fig. 5—Boiler Room.

The space in the yard on the west side of the boiler room is intended for cooling-tower installations.

BOILERS.

The four boilers in the new section are set with front headers 10 ft. above the floor line and are designed for operation at 200 lb. per square inch steam pressure. Two of the units are equipped with Babcock & Wilcox superheaters and two with Foster superheaters, all being designed to raise the steam temperature 125 deg. Fahr. at rated load. The boilers are equipped with thermometers in the steam pipes and differential draft gages are provided in each furnace. An ordinary draft gage is also fitted into the stack. The furnaces are equipped with chain-grate stokers designed to burn either Gallup slack or coal from the Trinidad region. The stokers are driven by engines, each of the latter being designed to drive four stokers, a quill and clutch being provided to eliminate friction in the shafting from the idle engine. The stokers are designed to drive the boilers up to 200 per cent of their rating.

WATER SUPPLY.

The water supply is drawn normally either from a well 5.5 ft. in diameter and 46 ft. deep or from an 8-in. well 325 ft. deep located on the premises. Connection is also made with the city water system. A Booth water softener of 4000 gal. per hour rating is provided, through which water from any one of the three sources can be passed. As

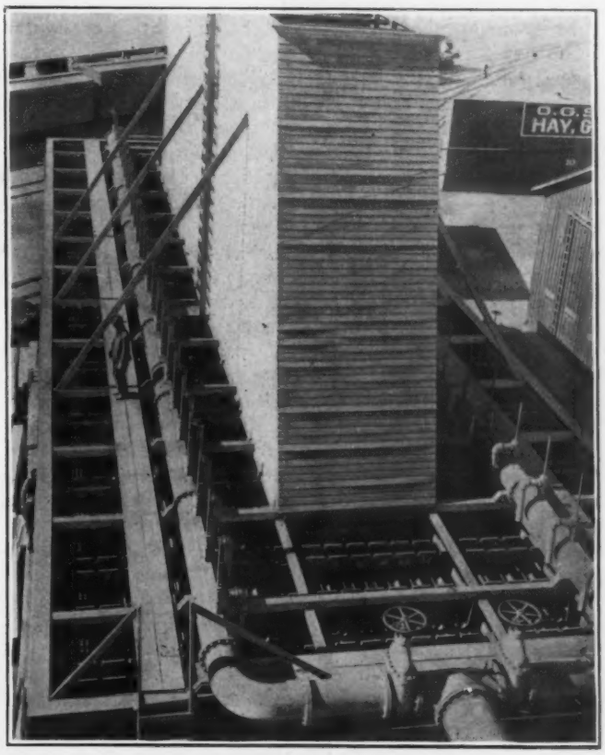


Fig. 6—Cooling Tower.

a rule water from the deep well is used for make-up boiler feed and for general station purposes, water for the 46-in. well for the condensing supply, and the city connection is held in reserve for fire and other purposes.

The water-softening plant is located in the yard behind the old boiler room. Hydrated lime and soda ash are used in the softening process. These are fed into the softener in solution, the relative amounts of lime and soda ash and the proper amount of the combined solution per unit quantity of raw water being determined by chemical analysis. The actual rate at which the chemical solution is fed to the softener is automatically kept proportional to the rate at which the water passes through the latter. This is accomplished by float valves acting in conjunction with standardized orifices, controlling the inflows.

The raw water is taken from the deep well and is fed into the float box, the proper rate of feed being obtained by throttling to the desired point. The float box discharges the water through a Sutro weir, which is of such shape that the amount of water discharged through it is at all times proportional to the head acting on it. The float, rising and falling with the head on the weir, controls the amount of

opening of the standard orifice through which the chemical solution is fed. The opening of the standard orifice is thus made proportional to the head on the weir and the ratio of solution to raw water is kept constant. After passing through the mixing tank the treated water runs into a settling tank, where the sludge is allowed to settle out. From the settler the water passes through an excelsior filter into a soft-water storage tank, whence it is pumped into the boiler-feed system.

Two Worthington horizontal, duplex, outside-center-packed boiler-feed pumps are installed in a pump section of the engine-room basement, and the piping is so arranged that the feed water may be drawn from the overhead heater, directly from the water-softening plant or from the city mains. In an emergency water may be drawn from the condenser cold well through a fire-pump suction-line connection. The discharge from the feed pumps is supplied to both the front and the rear drumheads of the boilers. The feed pumps are provided with iron removable fittings throughout on account of the characteristics of the water. Each pump is capable of supplying four boilers, giving a spare unit with the present number of boilers. On the extension of the boiler room to the full complement of eight boilers an additional feed pump will be installed in the space between the two present pumps. With this subdivision of three feed pumps for each set of eight boilers a spare pump will always be available. Williams pump governors are installed on the feed pumps.

The feed-water heater is located on a platform under the steel stack. Exhaust steam from all auxiliaries is piped to the heater, which is provided with a by-pass to the atmospheric exhaust through a relief valve. Make-up water for the heater is supplied from a system connected with an elevated tank of 40,000-gal. rating located in the yard behind the old boiler room, the main source of supply being the hot-well return from the main condensing units. The elevated tank has a diameter of 17 ft. and is built of ¼-in. steel plate, the distance from the ground to the bottom of the tank being 60 ft. Two outlets are provided, one connecting with an 8-in. pipe for fire protection and one with a 10-in. pipe for boiler feeding. The latter extends into the tank to a height sufficient to leave always 10,000 gal. for fire service. The low-service pumping equipment includes a 2-in. single-stage horizontal centrifugal pump driven by a 7.5-hp induction motor and a steam-driven horizontal duplex piston-pattern tank pump, each pump having a rating of 100 gal. per minute against a head of 100 ft. The motor-driven pump is provided with an automatic controller operated by a float in the elevated tank.

### PIPING.

Steam is taken from the boilers through 6-in. leads provided with New Bedford automatic non-return stop and check valves to a 12-in. main steam header located just above the main floor back of the boilers. Expansion is provided for by a vertical 180-deg. bend in the steam header where it passes through the stack bay. All valves in the header are arranged so that they can be operated from either the boiler-room or the basement floor. A valve placed in the main header close to the vertical bend permits the isolation of boilers on either side of the stack bay. Easy 90-deg. bends of 8-in. pipe take steam from the main header to the turbine throttles, and two 6-in. connections supply steam to an auxiliary steam header located in the engine-room basement. The boilers in the two sections of the plant are interconnected through a reducing valve for emergency service, the older units being capable of operation at a maximum of 150-lb. pressure. The exhaust steam from each turbine is carried to the condenser through a 36-in. hydraulically operated gate valve, with an independent outboard exhaust extending through an exhaust relief valve to the roof. The auxiliary low-pressure steam is taken from all the auxiliary apparatus to the feed-water heater, which is located between the two batteries of boilers in the new section of the station.

### ECONOMICAL EXHAUST-STEAM CONTROL.

The circulating pumps are driven by a direct-connected turbine and by a direct-connected variable-speed induction motor operating in combination with the former, this method of driving being adopted in order to gain the fullest control over the exhaust-steam supply. Both the circulating pump and the hot-well pump are of the centrifugal type and they are mounted on one shaft. The circulating pump is supplied with an exhauster for priming. In selecting this equipment it was understood that if at normal speed all the load of the circulating pump should be taken by the turbine the amount of exhaust steam delivered to the auxiliary exhaust main would probably be in excess of the amount needed to raise the temperature of the boiler feed to the boiling point. Operation under these conditions is undesirable. To prevent this the turbine has been provided with a governor capable of speed control over a fairly wide range of speed, and a variable speed induction motor was connected to the shaft, so that with a suitable speed adjustment any desired proportion of the total power required can be furnished by the motor. By having a speed-regulating device on each source of power, the absolute speed of the unit and thus the amount of circulating water handled

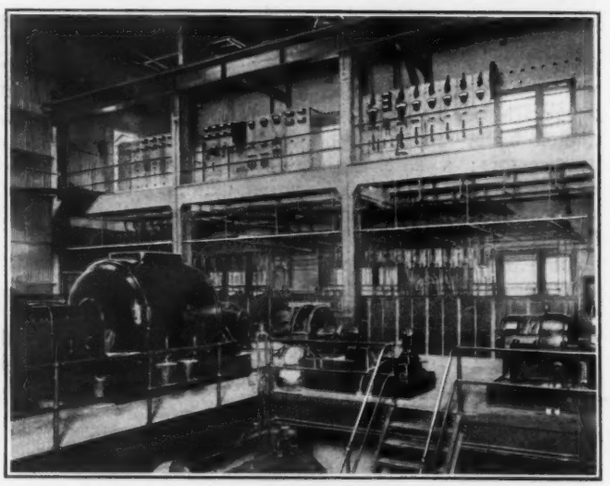


**Fig. 7—Switchboard Gallery.**

may be controlled, or the relative speed of the two sources of power may be controlled. This gives complete control over the supply of exhaust steam and facilitates economical operation.

Changes in the station load make readjustments of the speed conditions of the two units necessary for economy, and close watching is necessary to keep the feed temperature close to the atmospheric boiling point without any waste of exhaust steam. The speed variation of the induction motor is provided by an external resistance in the rotor circuit.

### AIR SERVICE.

The two air compressors for operating the air lift of the deep well and for general station service are located in the engine-room basement, and their intakes are connected to a 10-in. pipe leading from a main air chamber in the basement, where further connection is made with an air-washing system. The latter, provided by the Carrier Air Conditioning Company, New York, has a present rating of 25,000 cu. ft. per minute, an increase to 50,000 cu. ft. being planned in case an additional turbine of 5000-kw rating is later installed. The washer is located in a special compartment in the old engine room. Air is taken in from the roof through a chicken-wire screen, and after passing through the washer is led into a chamber whence it is drawn into the turbo-generators. A sheet-metal cover fitting the air

discharge opening of either turbine prevents air from being drawn in from the engine room through an idle machine.

PUMP SERVICE.

An Underwriters' fire pump of 1000 gal. per minute rating is located in the engine-room basement. The fire mains may also be supplied from the city service. When

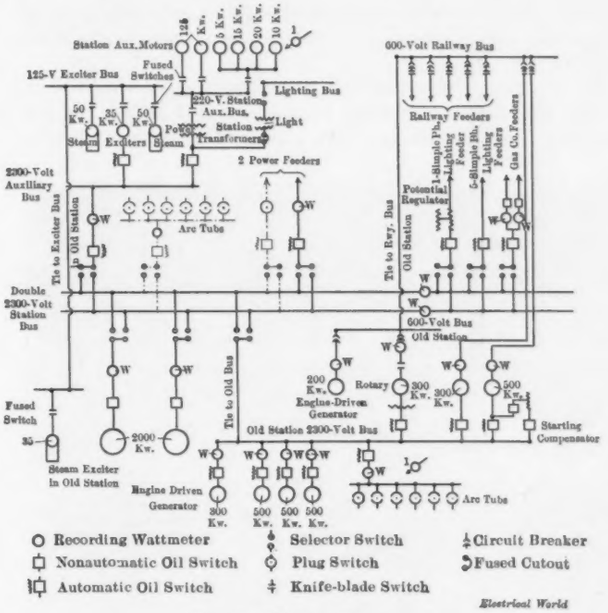



Fig. 8—Wiring Diagram.

the pump is used water can be drawn either from the feed-pump suction or from the cold wells. Venturi meters are provided in each discharge line from the condensation and circulating pumps. To insure accuracy in the readings of the manometers vent pipes are provided leading from the horizontal runs of the condensation-pump discharge lines to a point higher than the discharge level of the pumps at the open heater.

Each cooling tower supplies water to a cold well placed below the basement floor between each pair of condensers, the wells all being cross-connected by a 36-in. square tunnel. The discharge pipes of the circulating pumps are also cross-connected by a common header placed outside the building. To help out the old station, piping has been installed between the old and new cooling towers. Water for station service is taken from the discharge of the low-service pump, to which is also connected the 40,000-gal. tank outside the building through an 8-in. pipe to the feed-water heater, the flow being controlled by an automatic valve. From the feed-water heater the water passes through the water weigher below to the feed pumps, with a by-pass connection around the water weigher. There is also a supply from the water-softening plant through a 10-in. pipe to the feed pumps. From the latter water is carried directly to the boilers through a 6-in. cast-iron feed main with a 3-in. connection to each boiler. There is also an auxiliary feed to the rear of each boiler. Water for the fire pump is taken from the intake tunnel with an auxiliary connection from the water-softening plant.

All the main and high-pressure auxiliary steam piping is drained by the Holly gravity drip system. The hydraulically operated gate valves between the turbines and the condensers are supplied with water from the boiler-feed lines. Copper expansion joints are provided to relieve the turbine casings of stresses due to temperature changes, the joints connecting directly to each turbine exhaust nozzle and to the exhaust bend leading to each condenser.

SWITCHBOARD.

The electrical output of the station is controlled in part from the switchboard in the old engine room and in part from that in the newer section. The main switchboard, consisting of twenty-four marble panels, is located in the new station on the east side of the engine room. All 2300-volt panels are of the remotely controlled type, operating oil switches located below on the main floor of the switchboard bay. All oil switches, except those for station equipment, are of the solenoid type. The board controls seven single-phase feeders, one two-phase feeder, two 2000-kw turbo-generators, two steam-driven exciters, one motor-driven exciter, one station auxiliary circuit, one arc primary circuit, two motor-generator sets and five 550-volt railway feeders.

Between the new and the old stations are installed a two-phase main bus tie controlled by selector switches, a three-cable exciter bus tie, two positive direct-current railway cables and a positive railway bus tie to permit operation of the rotary or engine-driven railway generator on the new station buses.

The switchboard in the old station controls the vertical turbine units, the engine-driven generators, a steam-driven exciter and the rotary converter. Oil-switch cells in the station are of concrete construction, with no embedded reinforcement except the hardware in the switch mounting and assembly.

Energy for station auxiliaries is distributed from a panel at 220 volts alternating current. The direct-current crane motor is supplied from the railway bus. Energy for station lighting is taken from one phase of a 2300-volt station service bus, there being nine circuits for this purpose. Excitation is furnished normally by two 50-kw, 125-volt turbine-driven exciters or a 35-kw motor-driven exciter, all being installed in the new station. A tie has also been made between the exciter buses in the new and the old stations so that energy generated by a 30-kw engine-driven unit may be used if needed.

The station is unusually well equipped with instruments on both the steam and electrical sides. Among the apparatus of this kind installed are pressure gages on the

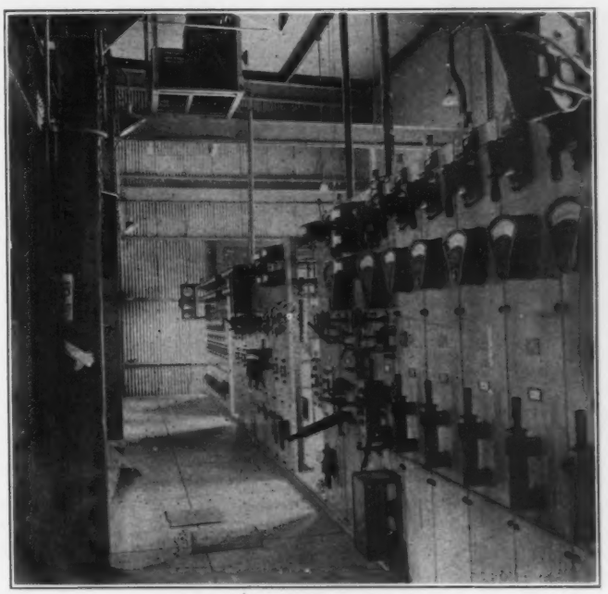


Fig. 9—Switchboard.

circulating-pump discharge pipes, a recording pressure gage on the main steam header within sight of the firemen, and thermometers on the heater discharge, on the boiler steam-delivery pipes, turbine steam pipes, turbine exhaust piping, hot-well pump discharge pipes, circulating-water discharge pipes, discharge from condensers, boiler uptakes and in generator armature windings.

## HIGH-POTENTIAL CABLE TESTING AT BOSTON.

### Portable Testing Apparatus and Methods Employed by the Boston Edison Company to Prevent Cable Breakdowns.

At a recent meeting of the Boston Edison Company section of the National Electric Light Association a paper upon high-potential cable testing was presented by Mr. C. L. Kasson, of the company's laboratory staff, describing in considerable detail the equipment and methods employed by the Boston organization in conducting high-voltage cable tests for the purpose of insuring reliable operation. Through the courtesy of the author the following material has been prepared, giving test data and a comprehensive description of the apparatus used.

The equipment is carried on two electric trucks of 5 and 6 tons carrying capacity. Each has a speed of about 7.5 miles per hour and is capable of making 30 miles on one battery charge. One truck carries an 800-kva, 30,000-volt or 15,000-volt to 2300-volt, 60-cycle air-cooled transformer; an 850-kva, 2300-volt, 60-cycle air-cooled reactor; two blower sets, a switchboard and spark-gap, potential measuring transformer, an interrupter, a power bridge, a complete galvanometer equipment, a reactor terminal board, jumper cables and an electrostatic voltmeter. The second truck carries a 100-kva motor-generator set, a starting compensator, a switchboard, a carrying cradle for all portable instruments, exploring coils, jumper cables and many small devices for facilitating the testing. The motor-generator set consists of a three-phase, 60-cycle, 2300-4000-volt induction motor driving a three-phase, 60-cycle, 2300-volt synchronous generator, with a 2-kw, 125-volt exciter. The weight of this truck loaded is about 12 tons. All connections are permanent except those which have to be made at each test.

In operating the apparatus a jumper cable is connected between the supply terminals for the 100-kva motor and the source of three-phase, 60-cycle, 2300-volt or 4000-volt power. The necessary cross-connections between trucks are made by jumpers, and a ground wire is connected from the trucks to a reliable ground. The cable under test is connected with the high-tension transformer equipment by jumpers sufficiently insulated to permit their lying on the floor or ground. All of the necessary measuring instruments are connected in at the switchboards. The motor-generator is then started with low voltage on the generator end. A reactor is connected in circuit so that it will balance the capacity effect of the cable, and the transformer, reactor and cable are made alive by closing the generator main switch. The generator pressure is then raised until the high-tension voltmeters show that the cable is receiving the desired potential.

Fig. 1—Motor-Generator Set and Control Apparatus.

Fig. 3—Portable Testing Equipment.

Fig. 2—Transformer, Blower and Reactor Equipment.

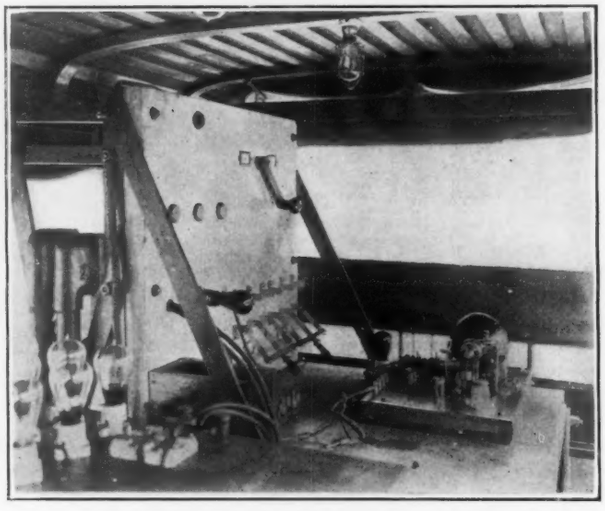


Fig. 4—Interrupter and Switchboard on Electric Truck.

If the cable stands the test the potential is gradually reduced at the end of the specified time and the switches are opened. If the cable fails, the fault is sufficiently carbonized to allow a 60-volt direct-current supply to force about 5 amp through it. This current is taken from the such a machine would be prohibitive for portable testing. Since the transformer is of 800-kva rating and the generator is of 100-kva rating, the shunted reactive load must always be within about 100 kva of the kva input to the transformer cables. The reactor is provided with nine

TABLE I—DATA OBTAINED DURING USE OF THE PORTABLE HIGH-POTENTIAL TESTING SET.

| Condition. | 30,000-Volt Side of Transformer. | | | | | Generator. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Volts. | Amp. | Kva. | Kw. | P. F. | Volts. | Amp. | Kva. | Kw. | P. F. | F. |
| 1-9 reactor only | .... | .... | .... | .... | .... | 2210 | 31.0 | 69.4 | 1.5 | 2.2 | 59.5 |
| Transformer only | 30,000 | .... | .... | .... | .... | 2120 | 25.0 | 53.0 | 3.3 | 6.1 | 59.5 |
| 1-9 reactor + transformer | 30,000 | .... | .... | .... | .... | 2130 | 51.0 | 108.0 | 4.4 | 4.1 | 59.5 |
| 14,875 ft. transmission cable (1 conductor) | 30,000 | 9.4 | 282 | 20 | 7.1 | 2080 | 18.3 | 38.2 | 30.5 | 78.5 | 59.0 |
| 14,875 ft. transmission cable (2 conductors) | 30,000 | 15.4 | 462 | 40 | 8.7 | 2040 | 30.5 | 62.2 | 54.0 | 87.0 | 59.0 |

| Condition. | Reactor. | | | | | Motor. | | | | | Exciter. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Volts. | Amp. | Kva. | Kw. | P. F. | Volts. | Amp. | Kva. | Kw. | P. F. | Volts. | Amp. | Kw. |
| 1-9 reactor only | 2210 | 31.0 | 69.4 | 1.5 | 2.2 | 2160 | 8.8 | 32.8 | ... | .... | 129 | 18.1 | 2.34 |
| Transformer only | .... | .... | .... | ... | ... | 2200 | 8.5 | 32.4 | 14.0 | 43.2 | 127 | 15.0 | 1.91 |
| 1-9 reactor + transformer | 2130 | 26.5 | 56.5 | ... | ... | 2200 | 10.0 | 38.1 | .... | .... | 126 | 22.1 | 2.78 |
| 14,875 ft. transmission cable (1 conductor) | 2080 | 105.0 | 218.0 | ... | ... | 2160 | 13.6 | 51.0 | .... | .... | 123 | 12.3 | 1.51 |
| 14,875 ft. transmission cable (2 conductors) | 2040 | 180.0 | 368.0 | ... | ... | 2160 | 20.8 | 77.5 | 67.0 | 86.5 | 119 | 13.7 | 1.50 |

truck batteries in conjunction with a lamp rheostat. The fault is located by using a power bridge, an interrupter with an exploring coil, or a combination of both methods. On new cables complete insulation resistance and electrostatic capacity galvanometer tests are made following a successful high-potential test.

taps to effect this. The generator provides the necessary wattless current to create a balance between the leading current in the transformer supplying the cable and the lagging current in the reactor, together with the necessary power component. The actual energy taken from the generator is used in supplying the core and copper losses of

TABLE II—DATA FROM TESTS ON UNDERGROUND CABLES.

(*Three-Conductor 15,000-Volt 7/32-in. Paper Cable.*)

| Line. | Conductor. | Length, Ft. | Test. | Volts. | Amp. | Kva. | Amp. per Mile. | Kva. per Mile. |
|---|---|---|---|---|---|---|---|---|
| A | 3-4/0 | 3,200 | 1-2, 3, 6 | 30,000 | 2.25 | 67.5 | 3.71 | 111.3 |
| B | 3-4/0 | 9,340 | 1-2, 3, 6 | 30,000 | 6.00 | 180.0 | 3.39 | 100.7 |
| C | 3-4/0 | 14,700 | 1-2, 3, 6 | 30,000 | 9.50 | 285.0 | 3.41 | 102.3 |
| D | 3-4/0 | 16,900 | 1-2, 3, 6 | 30,000 | 12.00 | 360.0 | 3.74 | 112.2 |
| E | 3-4/0 | 20,640 | 1-2, 3, 6 | 30,000 | 13.40 | 402.0 | 3.42 | 102.6 |
| F | 3-4/0 | 24,360 | 1-2, 3, 6 | 30,000 | 17.00 | 510.0 | 3.68 | 110.4 |
| G | 3-2/0 | 2,330 | 1, 2-3, 6 | 30,000 | 2.3 | 69.0 | 5.21 | 156.3 |
| H | 3-4/0 | 20,640 | 1, 2-3, 6 | 30,000 | 21.0 | 630.0 | 5.36 | 160.8 |
| I | 3-4/0 | 17,380 | 1-2, 3, 6 | 28,000 | 9.4 | 264.0 | 2.85 | 80.0 |
| J | 3-4/0 | 25,850 | 1-2, 3, 6 | 28,000 | 13.9 | 389.0 | 2.84 | 79.5 |
| K | 3-4/0 | 29,670 | 1-2, 3, 6 | 28,000 | 16.5 | 462.0 | 2.85 | 80.0 |
| L | 3-4/0 | 14,770 | 1, 2-3, 6 | 28,000 | 12.3 | 344.0 | 4.40 | 123.0 |

| Line. | Temperature, Deg. Fahr.* | Measured Insulator Resistance. | Insulator Resistance per Mile. | Measured Electric Capacity. | Electric Capacity per Mile. | Calculated Charging Current per Mile. |
|---|---|---|---|---|---|---|
| A | 38 | 149 | 90 | 0.199 | 0.328 | 3.70 |
| B | 36 | 231 | 408 | 0.527 | 0.298 | 3.37 |
| C | 40 | 52 | 145 | 0.894 | 0.321 | 3.62 |
| D | 51 | 19 | 61 | 1.15 | 0.359 | 4.05 |
| E | 37 | 46 | 179 | 1.20 | 0.307 | 3.46 |
| F | 36 | 96 | 440 | 1.38 | 0.300 | 3.38 |

*Air at mouth of duct.

The securing of a partial balance between the capacity of the cable and the inductance of the reactor used is the underlying principle of the whole equipment. A motor-generator set capable of handling the entire charging current would involve an 800-kva generator. The weight of the transformer, reactor and cable plus the cable dielectric heat losses. The relative value of some of these factors is shown in Table I.

In the case of the cable requiring 462 kva, the power taken is 40 kw. This makes the power-factor of the high-

tension circuit 8.7 per cent. The generator furnishes 62.2 kva and 54 kw, making its power-factor 87 per cent. The difference between the generator kw output and the high-tension kw consumed represents the transformer and reactor core and copper losses. The transformer losses are about 8 kw and the reactor losses 6 kw. If it is assumed that the $I^2R$ losses due to the current in the copper conductors and the lead sheath are negligible, then the 40 kw input to the cable must represent the power-producing heat in the dielectric, amounting to about 3 watts per foot of cable. Under usual conditions, when the generator is supplying some appreciable power component as well as wattless current, the wave-form of the potential impressed on the cable is approximately sinusoidal.

The equipment has now been used in over 100 tests on underground cable, ranging from 10,000-volt No. 6 rubber-covered single conductor to 15,000-volt No. 4-0 paper-insulated, three-conductor cable, the lengths varying from 500 ft. to 32,000 ft. The pressures applied in the tests have varied from 15,000 volts to 30,000 volts and the period of application from five minutes to thirty minutes.

Table II gives data compiled from the results of some of the high-potential and galvanometer tests. From the table it appears that the actual charging current is practically equal to the calculated current, which is based on the measured electrostatic capacity of the cable. As the galvanometer tests immediately followed the others, the temperature question did not have to be considered. The effect of the power component was assumed to be negligible with regard to heating. The figures show that the average charging current per mile at 30,000 volts and 60 cycles is about 3.6 amp for 15,000-volt, 7/32-in. paper cable when the test is from one conductor to the other two and sheath, at temperatures between 30 deg. and 50 deg. Fahr. The input corresponds to about 107 kva per mile. The table indicates that the charging current and kva necessary when the test combination is two conductors to the other one and sheath is about 50 per cent greater than that necessary when the combination is one conductor to the other two and sheath.

## RAISING THE STANDARD OF CABLE SPECIFICATIONS.

### A Practical Recommendation for Good Electrical Conductors and a Method for Tabulating the Important Requirements.

By Alden W. Welch.

THE large central-station corporations are awakening to the necessity for an adequate understanding of electrical conductors. At present the engineers in these companies responsible for the preparation of wire and cable specifications have such a multiplicity of duties that they find little time to devote to this subject. The result is that in the majority of cases many serious defects appear in the specifications. The field of cable engineering is broad and the details necessary for the thorough equipment of a cable engineer are innumerable.

It is the general but erroneous impression among central-station companies that the cable concerns are only a little removed from sharp-practice men. It has been the writer's experience that they are ever ready to offer suggestions and assist generally in the uplift of the art. They have on occasion even stated that certain specifications were too lenient. Reputable cable manufacturers are desirous of meeting high-grade requirements which make it possible for them to compete with the less conscientious concerns. These cable companies do not care to jeopardize their reputations by using the inferior materials allowed by lax specifications.

In a certain authentic instance where estimates were requested from three cable manufacturers the successful bidder wrote that his estimate covered the type of cable standard with that lighting company, but that he could supply an inferior cable which would still meet the tests required in the specification. The specification in this case contained no clause that called for Para rubber or even new rubber; in fact, no mention was made of any of the constituents of the filler. Hence anything that could withstand the high voltage, the insulation resistance and the stretch tests would be legitimate. In writing thus this manufacturer sounded his note of warning and the company could either recognize it or "take a chance," as it pleased. Upon inquiry as to the difference in quality between the two types of insulation his reply was very vague, but through it all was a strong recommendation that the standard should not be lowered. He stated that the difference was in the factor of safety.

RELATIVE COSTS OF BARE AND TRIPLE-BRAIDED WEATHERPROOF STRANDED CONDUCTOR.

| Size, Circ. Mil. | Cost in Dollars per Mile. | | | Insulation in Percentage of Total Insulated Cable. |
|---|---|---|---|---|
| | Bare. | Insulated. | Difference. | |
| 1,000,000 | 2,124 | 2,522 | 398 | 16.0 |
| 750,000 | 1,592 | 1,937 | 345 | 18.0 |
| 500,000 | 1,060 | 1,300 | 240 | 18.5 |
| 350,000 | 742 | 923 | 181 | 19.5 |
| 250,000 | 530 | 676 | 146 | 21.5 |
| No.0000 | 441 | 549 | 102 | 18.5 |
| 000 | 352 | 449 | 97 | 21.5 |
| 00 | 280 | 359 | 79 | 22.0 |
| 0 | 223 | 291 | 68 | 23.0 |
| 1 | 177 | 226 | 49 | 21.5 |
| 2 | 139 | 185 | 46 | 25.0 |
| 4 | 87 | 117 | 30 | 25.5 |
| 6 | 55 | 79 | 24 | 30.0 |

The duration of life of a cable is expressed by the factor of safety, a term that has not been clearly defined. A numerical value for this factor cannot be specified. It is, therefore, necessary to specify such material as will assure of its being high enough. The life of an electrical conductor depends upon certain extraneous influences which prevail. A storm or lightning discharge might devastate overhead construction at any time. In the case of underground cables electrolysis may in time, perhaps very quickly, destroy the lead sheath of a paper-insulated cable. Operations in the street often result in mechanical injury to an underground cable. Moreover, the development in the art sometimes makes a particular type of cable obsolete and inadequate for the purpose, so that it must be replaced by another cable. It is therefore difficult to give a reasonable estimate of cable life without knowing the conditions. However, under average conditions an underground cable protected from electrolysis should last twenty years. The

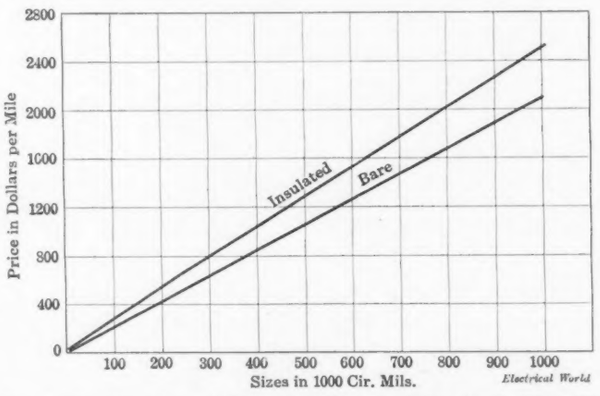



Fig. 1—Bearing of Insulation Upon Cost of Cable (Triple-Braided Weatherproof Stranded Conductors).

writer is personally aware of some that have been in operation for fifteen years. Such cables have entirely adequate factors of safety.

The strongest opponents to good cable specifications are the super-economic policies of the large central-station companies and ignorance of cable requirements on the part of those who draw up the specifications. Of course, there is much to be said on the side of economy in this direction. Fifty per cent of the equipment of such a company is often underground in the form of conductors. Hence even a small saving per foot in cables will assume large proportions in the aggregate. But there is a depreciation factor to be contended with. A small additional expenditure per foot might increase the life of the conductor to such an extent that the aggregate saving in depreciation would far outbalance the additional first cost. This is a matter to be carefully considered, and it is believed that an investigation of it would result in a demand for a higher standard of conductor. The second opponent should not be allowed to exist.

The complex quantity in cable engineering is the insulation. As far as the copper itself is concerned, few recommendations could be offered. Most specifications require a conductivity of not less than 98 per cent, "Matthiessen's standard." In addition to this it might be well to state a certain percentage of elongation for a test piece of given dimensions. However, this is not absolutely necessary if the conductivity is standard. In the writer's opinion, it is not desirable for the company to specify a strand pitch. This is a feature of construction that should be left to the manufacturer.

The accompanying table and Fig. 1 give an idea of the relation between cost of bare conductor and the insulation. It is an argument in favor of good material for the latter. A small percentage increase in the cost of the insulation will mean an exceedingly small increase in the total cost of the cable.

A recommendation that the writer desires to make to all electric-service companies, large and small alike, is that they prepare a tabulation of the significant data contained in their cable specifications. In most cases, always where large quantites are involved, cable should be ordered by a regular written specification. But there are times when cable can be ordered directly from such a tabulation. Specifications can be written quickly from this table. It is invaluable in the revision of specifications, as the important features are spread out before one and errors and defects can readily be detected therefrom. A form for such a tabulation is shown in Fig. 2.

In addition to this use should be made of a loose-leaf book containing all of the written specifications. The book should be fully indexed. The column in Fig. 2 called "Page Number" should refer to this index, and the figures occurring in this column relate to the rotation in which the specifications follow in the book. Under "Specification Number" should appear the actual numbers of the cable specifications. In an engineering department many specifications are written on all subjects from cables to buildings and each receives a serial number in the order of date. Hence the cable specifications would have all sorts of numbers, according to the time when they were prepared. With such a system this second column is necessary. In case the cable specifications were kept separate from the others they would be numbered consecutively and the first two columns of the table merged into one.

The description of the cable should be brief and to the point. A 250,000-circ. mil, three-conductor, varnished-cambric, lead-covered, high-tension cable should be designated as 250,000, 3-C, V-C, L-C, H-T; a 1,000,000-circ. mil, single-conductor, paper-insulated, lead-covered, low-tension cable should be designated as 1,000,000, 1-C, P-I, L-C, L-T, and other cables in a similar manner.

CABLE SPECIFICATIONS.

| | | | (1) | (2) | (3) | (4) | | (5) | (6) | (7) | (8) | | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Page No. | Spec. No. | Description of Cable | A.C. or D.C. | Normal Working Pressure | Test Voltage for 30 Min. | Thickness of Covering | | Covering | Insul'n Resist. | Guarantee | | | Wrapped around Radius, Inches | Number of Strands per Condue. | Insulation Test | Uses |
| | | | | | | Each Cond. | Over All | | | Service | Carrying Capacity Amps. | Time | | | | |
| | | | | | | | | | | | | | | | | |

Electrical World

Fig. 2—Form for Cable Specification Tabulation.

The next column states whether the cable is to be used for alternating current or direct current. Then follows the normal working pressure which determines the thickness of the insulation, and next the high-voltage test. The fourth of the numbered columns specifies the thickness of the insulation, and the fifth the type. The insulation resistance appears next, and after this the guarantees. Under "Service" should be inserted the time for which the cable is guaranteed by the manufacturer. The ninth column specifies the wrapping radius. The tenth gives the number of individual strands.

The scope of the test for insulation resistance should be shown in column eleven. In the case of three-conductor cable, it would state "between each conductor and other two," and if lead-covered, "between conductors and sheath." If single-conductor, rubber-insulated, braided service cable, it would read, "Insulation test to be made between core and a layer of tinfoil around braid." The last column indicates the uses to which the conductors will be put, such as for two-phase primary overhead, standard three-phase transmission outside station, direct-current service leads and mains and direct-current feeders.

The cable tabulation should appeal as a good scheme to engineers who are considering the cable situation. The writer would advise those who have not yet awakened to the importance of the subject to examine carefully their specifications with a view to eliminating all defects and errors of commission and omission appearing therein.

## SINGULAR ACTION OF LIGHTNING.

A curious prank played by lightning caused serious embarrassment to the Union Gas & Electric Company, of Cincinnati, at its generating station not long ago, setting fire to the main outgoing underground feeders where the latter leave the basement of the building. The bolt struck the upper steel work of the plant structure and followed down a corner column until it reached the floor level on which the feeder regulators are installed. Here it jumped across to the metal tank of one of the regulators, puncturing the sheet steel and releasing a stream of oil, which it also ignited. This burning oil poured down upon the feeder lines near the point where they leave the building, and when the fire was discovered the cable insulation was burning fiercely. In all, about a barrel of oil thus escaped from the regulator tank and was added to the fuel of the burning feeder coverings, making the fire difficult to combat. It was necessary to de-energize the feeders for a time, until the flames could be extinguished and hasty repairs made around the burned section.

# Central Station
## Management, Policies and Commercial Methods

### LARGE GARAGE FOR FRESNO.

The San Joaquin Light & Power Company is planning to build a garage and shop in Fresno, Cal., to care for the many automobiles which it owns. The garage and shops will cost in the neighborhood of $11,000. The shop will occupy an area 150 ft. by 100 ft. and the garage will occupy an area about 62½ ft. by 150 ft. The company owns seventy-six automobiles, including trucks. All of these are not quartered in Fresno, as the company has a fine garage and shop in Bakersfield. The machines used in the northern district, however, are quartered in Fresno.

### FRONTAGE CHARGES IN ORNAMENTAL STREET LIGHTING.

The problem of the corner-property owner or tenant has vexed many central-station men promoting local "white ways" or ornamental lighting installations. Strenuous are the objections raised by the corner merchant who finds he must pay on a curb-foot basis for both his main fronting and his usually longer side-street fronting, while the man next door is charged only a quarter as much for his share in the middle of the block. The difficulties thus created had proved almost fatal to the plans for tungsten curb fixtures at Great Falls, Mont., where the corner-property objectors quite refused to go into the agreement. An adjustment was finally secured, however, by installing 32-cp lamp in the alleys behind the stores, and charging these lamps to the mid-block occupants, on the same curb foot basis as in front. The conduits for the curb fixtures are fed through overhead lines in the alleys adjoining the main street, so that it was a simple matter to install 32-cp graphitized lamps and reflectors on these wooden poles. The presence of these alley lamps will also have a positive police value, aiding in the capture of criminals and preventing depredations on merchants' stores from the rear. Under the new arrangement, therefore, the cost of erecting and operating the lamps is borne on a footage basis in which both front-street and alley frontings are counted equally. The result has been to reduce the discrepancy between the corner and mid-block occupants to a point where the former were all satisfied to come in.

Ornamental Curb-Lighting Post for Great Falls, Mont.

Eighty posts, each carrying four 60-watt till-midnight lamps and one 100-watt all-night lamp, are being installed, the illuminated area extending from Park Drive to Sixth Street, one-half block on each side of Central. The posts are of an elaborate type manufactured locally by the Great Falls Iron Works, and cost $135 each, completely installed. The Great Falls Electric Properties operates the entire system, including the alley lamps, at the rate of $6 per curb post per month. There are two of the alley lamps to each block, located at points one-third the distance between streets. Under a recently enacted Montana statute, the cost of building and operating this ornamental lighting system will be borne one-half by the city government, one-third by the abutting owners and tenants, and one sixth by the street railway company, the latter being required by law to contribute this amount to the lighting of streets traversed by its cars.

### TRANSFORMING A DOUBLE-CURRENT GENERATOR INTO A ROTARY CONVERTER.

An interesting transformation is in progress at the Harrison Street station of the Commonwealth Edison Company of Chicago. This station was built about twenty years ago, and at that time was considered to represent the latest developments in the art. One of the units was a 2500-kw double-current generator driven at 75 r.p.m. by a vertical Allis engine. This station has been superseded almost entirely as a generating plant by the more modern steam-turbine stations, where electrical energy is produced more cheaply. It is now used principally as a substation, the greater part of the steam generating equipment being held in reserve for winter peak loads. It has been decided, however, to transform the double-current generator into a rotary converter.

Originally this generator supplied either direct current or alternating current. In the course of the changes under way the connecting rods of the engine have been removed, although the flywheel still remains part of the unit. The double-current winding of the generator is practically identical with that of the ordinary rotary converter. Inasmuch as the unit was originally equipped with an alternating-current regulator and step-up transformers to make it operative on the 9000-volt system of the company, about the only change necessary on the generator side consists in providing a rather elaborate starting equipment. As a synchronous converter the machine will have a direct-current pressure ranging from about 250 to 300 volts.

The new unit, as intended to be operated, is a ponderous one and will probably be used for the most part during the heavy demands of the winter season. This change is an interesting example of the resourceful expedients which can sometimes be employed by the larger central station companies in utilizing obsolete equipment.

### SECURITY OF ELECTRIC SIGNS.

A recent windstorm in Cincinnati that assumed the proportions of a cyclone blew down many electric signs, and in a number of cases the electrical wires were left exposed. Mr. William Carroll, former city electrician of Chicago, who happened to be in Cincinnati at the time of the storm,

has suggested to the Department of Electricity of the city of Chicago that it might be advisable to look into the manner of fastening large electric roof signs.

The requirements of the Electrical Code of Chicago in relation to the supporting and guying of electric signs are very rigid, and investigation reveals the fact that, so far as known, no electric roof sign or electric sign projecting from a building has ever been blown down. In the case of projecting signs the character of supporting chains and cables is carefully specified for signs weighing less than 75 lb., between 75 lb. and 150 lb., between 150 lb. and 250 lb., and between 250 lb. and 350 lb. Signs weighing more than 350 lb., or signs supported by cables or chains which form an angle of less than 30 deg. with the horizon, must not be erected until the detail plan of supporting has been submitted to the city electrician and received his approval.

In the case of roof signs the Department of Electricity issues permits covering only the electrical work, one requirement being that the wires be led in conduits up to the sign. The plans for the structures of roof signs must be approved by the Department of Buildings. All electric roof-sign structures must be of steel-skeleton construction designed by a licensed structural engineer, and plans showing construction and method of attachment to buildings must be submitted to and approved by the architectural engineer of the Department of Buildings of the city of Chicago. The structural work is inspected during erection and annually thereafter. There is no record of any of the electric roof signs of Chicago having failed during any windstorm. The Department of Buildings does not issue permits for roof signs on buildings over eight stories high or for wooden signs or billboards on roofs. Such billboards as are in position on roofs were erected before the present ordinance was adopted. They have been allowed to remain, but they must be strengthened, where necessary, to withstand a wind pressure of 25 lb. to the square foot.

## CENTRAL-STATION ICE MAKING.

By H. J. MACINTIRE.

The criterion as to the most economical refrigerating installations depends on the cost of fuel and electric energy, and, to a certain extent, on the available space. Undoubtedly in the coal regions where fuel costs are at a minimum and where the engine-room space is of small importance, the steam-driven can-ice plant has its advantages, but it must be remembered that the can-ice plant is but one of a large number of uses to which refrigerating is now being put. The reason why this particular kind of work has been considered especially is that the ice plant is well adapted to central-station conditions, although examples are frequent now of a large number of other industries being carried on by the central station, for instance in Buffalo, Detroit and in some of the Southern and Western localities. In none but the can-ice plant is distilled water desired to any extent, and often therefore the chief argument for the steam-driven compressor becomes of no great importance. It is then desirable to discover other means for obtaining refrigeration.

The absorption machine has lately been brought forward, and there is no doubt that it has been greatly improved, both by experiments and study of its action. It is, however, still in the experimental stage, and the near future will show even greater improvements than the past has done. The particular advantage of the machine is its ability to utilize the latent heat of the steam and to work as economically with exhaust steam as with the higher pressures. When one considers that the ordinary steam engine utilizes only about 5 to 15 per cent of the heat in the steam the advantages of an apparatus to make use of a greater percentage are apparent, as in the case of steam heating, when exhaust steam only is used. Unfortunately, however, the absorption machine has for various reasons acquired a bad name which will take some time to overcome. Although the machine can run perfectly well on exhaust steam, it must be designed for the particular condition under which operation is desired. The generator operating with steam at 3.5 lb. should have 14.5 sq. ft. of heating surface per ton of refrigeration, whereas 16.5 sq. ft. per ton is required with steam at 1 lb. Again the steam going to the coils should be dry, and especial attention should be paid to the problem of securing dry and saturated steam by having a large and efficient steam separator just before the entrance to the steam coils. With the proper amount of steam surface in the generator and with dry steam there is no reason at all why the absorption machine cannot be depended on to do the required amount of work.

The advantage of the absorption machine lies directly in the use of exhaust steam, either from the large prime movers or from the pumps or auxiliary apparatus driven by steam. The ease with which a low refrigerating temperature may be secured—one of — 10 deg. or — 20 deg. being easy to achieve without appreciable increase in operating cost—is another advantage in this type of machine. The disadvantages are several. The initial cost of the absorption machine is excessive, being usually twice as great as that of a compressor machine of an equal capacity. The space occupied by the former is at least twice and sometimes three times as great as that needed by the latter. The cycle is complicated and requires especial attention on the part of the operating engineer. When in good condition it is, however, easily run, there being only one small pump that moves. The steam rate is about that of the steam engine and similar prime movers; that is, about 30 lb. steam per ton of ice.

The ice plant, which, especially in the Southern States, has been the real dividend earner, may be of the plate or can system, and the can system need not have condensed steam from the boiler only but may have three other arrangements. The plate-ice system is a device by which a salt solution, usually $CaCl_2$, is circulated in a flat coil of pipe immersed in the water to be frozen. The salt solution, or brine, is quite cold, usually 0 deg. Fahr., and the water begins to freeze and to adhere to the metal plate. The process is continued for two or more days, the time depending on the desired thickness of the ice, and the water is agitated slightly to promote clearness by preventing air from adhering to the ice at the sides. Clear raw-water ice may be made in the can system in two ways, both requiring slight agitation of the water to clear the ice from air bubbles, which, if permitted, would give the ice an opaque look. One of these ways is to continue the freezing until only a small pocket remains unfrozen and then, removing this water, to refill the pocket with distilled water. The second way is to use cans of four times the usual size, and then, when the freezing process is complete, to saw the ice into four parts, thereby making the white core appear as a slight imperfection of one edge, which may be trimmed off if desired. Another method especially successful in Buffalo is to secure distilled water by means of a multiple still. This is an apparatus receiving steam at ordinary boiler pressure where by an arrangement of cells and counter-flow surfaces 10 lb. or 12 lb. of distilled water may be obtained from 1 lb. of steam. This distilled water, which has not been used in engines, does not have to be purified and can be put immediately into the cans to be frozen. The above methods for the solution of the problems of ice manufacture answer completely the chief arguments for the use of the steam engine.

The desirability of the electric motor for the central station as well as for the isolated plant lies, of course, in the increased yearly load-factor. However, the manufacturer, except in highly favored localities, will be concerned with the question of cost of energy for the electric-driven com-

pressor. This, of course, depends on the local rate or the cost of energy at the busbar. There is another variable depending on the coolness of the water available, the suction pressure and the kind of compressor used, these all affecting the energy consumption per ton of ice. It is a well-known fact that a compressor with a large balanced suction valve, preferably in the piston, has less wire-drawing loss, and such a piston having as well a small clearance and using the dry compression has a large volumetric efficiency. These facts have been brought out time and time again both by competitive and by shop tests, and the results are such as to defy question. The problem of the suction pressure is easily cleared. The capacity of a compressor depends on the number of pounds of ammonia condensed and passed through the expansion valves into the cooling coils, this amount varying from 30 lb. to 40 lb. of ammonia per ton of refrigeration per hour. The volume of this ammonia depends, however, on the pressure of the vapor during the suction stroke in the cylinder itself. If the cylinder is very warm and superheating takes place to a marked degree, or if there is much reduction of pressure during the passage through the valve, or if there is much re-expansion loss due to the clearance, then the displacement of the piston per ton of refrigeration becomes a maximum, and likewise the energy required to drive the compressor becomes a maximum. Therefore the cost of refrigeration increases with the suction vapor's volume and also with the pressure of the suction. The cooling water available also affects the economy of operation, as the warmer the water the higher the condensing pressure and therefore the greater the amount of compressor work.

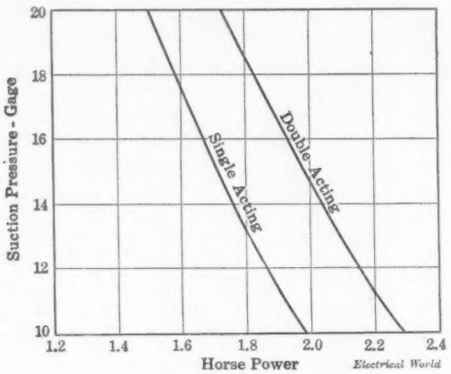



Fig. 1—Power Required to Operate Compressors.

The usual conditions in the summer allow condenser pressures of about 165 lb. gage, which means that the water entering the condenser must be at a temperature of about 80 deg. Fahr. From tests already referred to it is evident that there will be required 1.34 hp of the compressor per ton of refrigeration for the single-acting vertical machine and 1.53 hp of the compressor for the double-acting horizontal machine, using a suction pressure of about 15.5 lb., whereas with 20 lb. pressure of suction the power will be respectively 1.20 hp and 1.36 hp and with 10 lb. pressure 1.56 hp and 1.80 hp respectively. The size of motor required may be obtained by adding 15 per cent. Fig. 1 shows the power necessary for the motor, assuming the efficiency of the latter to be 90 per cent and the friction loss on the compressor to be 15 per cent, the power applied being worked out for both the single-acting and the horizontal double-acting machines for several suction pressures. It is therefore seen that a ton of refrigeration requires from 1.1 kw to 1.5 kw per hour for twenty-four hours for the vertical compressor and a little more for the horizontal or small suction-valve compressors. At 1.5 kw this will amount to only 36 kw-hr. and it will drop to about 27 kw-hr. in the case of the higher suction pressure. The cost of ice is a little more than that of refrigeration and depends on the temperature of the water to be frozen, the final temperature of the ice and the loss due to thawing and sawing when taken from the freezing room. Fig. 2 has been drawn assuming a 10 per cent loss for the latter and a uniform temperature of the ice of 10 deg. Fahr. The abscissa represents the coefficient which must be used as a divider to convert tons of refrigeration to tons of ice. From these two diagrams a close idea may be had of the cost in kilowatts of motor-driven compressors. The actual cost of a ton of ice in dollars varies with the cost of a kilowatt-hour. In the central station this becomes a minimum and also, as has been explained, is a real advantage in the operation of the plant by providing it with an off-peak load.

The required amount of refrigeration varies with the time of year, and the load is a maximum for a short period only. The capacity of a compressor, however, is dependent on the revolutions per minute, and this may be adjusted from day to day so as to carry the load successfully. The best arrangement is to have a number of compressors of various sizes which can be used as the load demands, and have each unit run at highest capacity, especially as the efficiency of $NH_3$ compressors is a constant for sizes above 20 tons. Sometimes it is desirable to have a large brine-storage tank, which may be chilled by running the compressor at full rating and thereby storing up as much refrigeration as is needed through the circulation of the brine alone. This, however, requires a rather large space for the storage of the brine, which must be very well insulated, thereby increasing the first cost. The more usual way, although perhaps the less efficient, is to have a variable-speed motor.

As an example of the cheap production of ice by the use of electrically driven compressors, the results of a plant in Buffalo may be given. The ice plant, which is of 100 tons capacity, has a 200-hp, 25-cycle induction motor wound for thirteen speeds. City water was used, but was first filtered to promote purity, and small motors amounting to about 50 hp drove the auxiliaries, such as saws, hoists, etc. The cost of energy is very low, and the amount of power required during the summer varied with local conditions such as condensing pressure and the temperature of the water to be frozen when placed in the tanks, and so with the different months the power per ton varied from 57 hp to 116 hp with an average of 86.8 hp for eleven months. The cost of energy was 35.6 cents per ton, and the cost of labor up to the point of the loading platform was 36 cents, a total of 71.6 cents per ton. The cost per ton using the can system and the multiple still has been found to be even less, but it must be remembered that such low rates are only possible at the site or in the neighborhood of large hydroelectric developments.

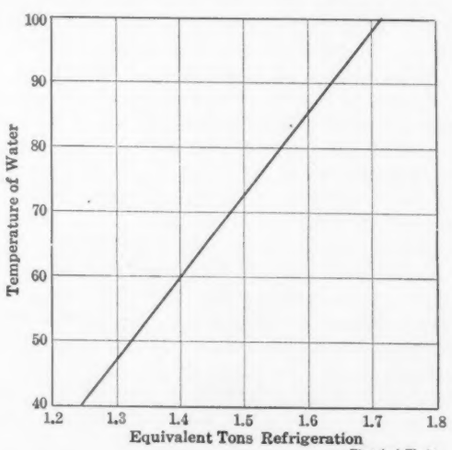



Fig. 2—Coefficient of Refrigeration for Various Temperatures.

# Wiring and Illumination

## ARTIFICIAL GRANITE POSTS CAST IN POSITION.

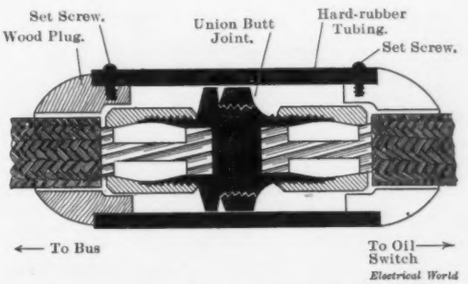
Ornamental tungsten curb lighting has been used with excellent effect in opening up the new "Wildwood" residential section of Fort Wayne, Ind., the attractive illumination rendering the addition so popular that purchasers were quickly found for the high-class dwellings which a promoting real-estate company built there. While this is not the first time that special electric lighting has been used to popularize a new district quickly, the results in the Fort Wayne case show how a small investment in lighting fixtures may greatly increase the convertibility of real-estate holdings.

Fourteen posts, each carrying a single 40-watt lamp in a milk-glass ball globe, were installed in a curb length of 1212 ft., the construction cost complete, including the laying of conduit, being $0.65 per curb-foot. The posts are of concrete made up with crushed red granite and mica and, except for their size, are generally similar to the Lincoln Park posts, Chicago. Those at Fort Wayne were, however, built erect in position, the forms being in two sections, allowing the lower half to be poured first, after which the upper section was completed. The posts are 10 ft. high and measure 7 in. in section at the top and 20 in. at the base.

Use of base outlet boxes for attaching the post circuit to the conduit was avoided by bringing the conduit directly up to the lamp through the cored space in the post, returning it down again in the same way to the run to the next post. In this way the conduit is looped directly to the lamp socket at each post, without the necessity for base entries or outlet boxes.

## DISCONNECT COUPLING FOR OIL-SWITCH LEADS.

In the installation of oil switches, lack of space or other conditions sometimes make it impossible to locate disconnect switches between the oil switch and bus, where the use of such switches would be advisable to render the oil switch "dead" for adjustment or repairs. This condition existed in the 2300-volt construction of the great motor-driven compressor station of the Anaconda Mining Company at Butte, Mont., where the 300-amp oil switches were installed with terminals connected directly through vertical leads to the buses. To take the place of disconnect knife switches and make possible repairs on the apparatus, Mr. W. S. Guthrie, chief electrician, designed the insulated joint feature shown herewith, the special fittings being made on




Disconnect Coupling for Oil-Switch Leads.

order by the manufacturer of the solderless fittings used. In place of the usual solid hexagon nut employed on ordinary Dossert couplings, the fitting is broken into two parts held together by a union nut coupling, which makes a firm butt contact between the 1-in. flat bearing surfaces. This nut can be unscrewed with an insulated-handle wrench, opening the line and disconnecting the device. The connector parts are protected against short-circuit or accidental contact by the hard-rubber covering shown. After investigating the cost of special hard-rubber castings for the purpose and finding the expense of these such as to make them out of the question, Mr. Guthrie was able to utilize stock rubber tubing 1.75 in. in diameter, cut into 6-in. lengths. These tube sections are held in position by the filled-wood cap pieces, which are in turn fixed in place by small set-screws. To gain access to the connector it is necessary merely to remove the upper screw, allowing the tube section to drop down out of the way so that the hexagon nut can be gripped with the insulated wrench.

## WIRING OLD HOUSES—IV.

### Concluding Instalment Describing the Methods Employed by the Allegheny County Light Company—Construction and Installation of Panel Boxes.

By Terrell Croft.

The preceding instalment of this article, which appeared in the Aug. 10 issue, dealt with methods of running wires in partitions and means of passing obstructions in reaching wall outlets.

A convenient method of locating the center of a ceiling, preparatory to installing a ceiling fixture, is shown in Fig. 28. The wireman measures the length and width of the room, on the floor, as indicated by $A$, $A'$, $B$ and $B'$, and locates the room center $C$ on the floor. Then with a plumb bob the point $C$ is transferred to the ceiling, as shown at $C'$ in the sectional elevation (Fig. 28).

Before cutting a large hole for an outlet or outlet box the wireman should always assure himself that the wires can be brought to the outlet. He should first prepare the wire route to the outlet location and then cut the outlet hole. Sometimes it is necessary to bore a small "exploring hole" through which a mouse can be inserted, at the point where the outlet is desired, before the outlet hole is cut. The mouse can be dropped down within the partition to ascertain if the contemplated route is clear of obstructions.

In cutting a hole for an outlet box, switch or fixture, in a finished partition, the wireman should locate the laths in the vicinity by probing with a very fine finishing nail. By thus locating the laths he can so cut the hole that the screws supporting the outlet box will each engage a lath and the hole through the surface will be no larger than necessary. The face plates of switches are only ¼ in. to ⅜ in. larger than the hole that must be cut for the outlet box, so very careful work is necessary to insure that, after the job is completed, the hole will not show beyond the face plate. It is frequently necessary to cut holes for loom through plaster of paris fixture canopies. A Syracuse twist drill is the best tool for this purpose. It may be used in a bit brace and will quickly cut a smooth, round hole. Such a hole should always be bored upward into the ceiling; if it is bored from the ceiling space downward into the room plaster will probably chip off around the hole.

When installing a flush switch considerable time will be saved if wires of the proper length are connected to the switch and sheathed with loom before they are drawn in. (See Fig. 29.) The wires will then draw the switch and its outlet box into place. The outlet box is fastened in position with wood screws and the free ends of the conductors are soldered to their proper connections. This method is preferable to the reverse procedure of pulling the wires in from the opposite direction and connecting the switch last. The method advocated is usually preferable because the wireman, when connect-

ing the wires to the switch, is not hampered by having to work in the confined space of an outlet box. Another advantage of the "pulling in complete" method lies in the diminished risk of damaging the plaster around the sides of the outlet hole. Where wires are pulled in and left protruding from the outlet until the switch can be connected they are necessarily handled to some extent, and

In installing a panel box the wireman determines where it shall be located and ascertains the dimensions of the space available. He then builds or has built a box like that shown in Fig. 31. The ⅛-in. asbestos lining is held in place with glue or flow paste. Sometimes a wiring gutter is not used, but it is desirable because the inside of the box can be wired more neatly. The box is held in place in

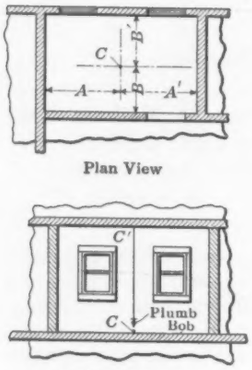



Fig. 28—Locating Center of Ceiling.

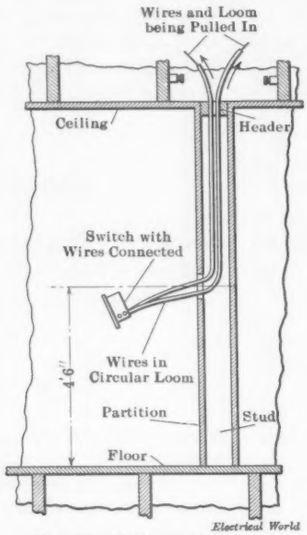



Fig. 29—Method of Pulling in Switch Box.

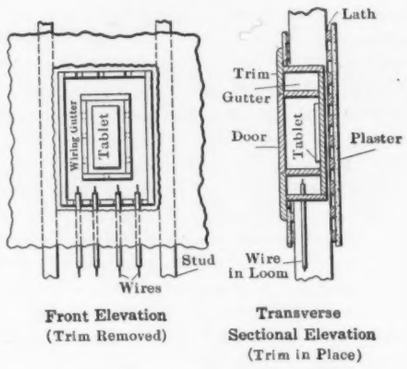



Fig. 30—Panel Box in Position.

this tends to break away the plaster. Therefore, when installing a flush switch in a partition make sure first that a wire route is available and then proceed as follows: First, cut the outlet hole the exact size of the box; second, make up conductors of the proper length, connect them to the switch and cover them with circular loom; third, drop a mouse into the hole from above, attach it to the wires, and pull in the entire unit consisting of switch, steel switchbox, conductors and loom.

In old residences requiring four or more branch circuits (a maximum load of 660 watts being permitted on each branch) it is usually desirable to install a panel box in a central location. Figs. 30, 31 and 32 show the construction and installation of such a panel box. The slate tablet that carries the main switch and fuse holders is the only part of the panel-box equipment that is purchased. The box (Fig. 31) is sometimes made by the wiremen and sometimes by a carpenter. The trim (Fig. 32) is supplied by a carpenter and made of the same material as, or finished to match, the adjacent woodwork. It is not feasible to purchase the box and trim ready-made from an electrical supply dealer because each installation is usually special, as regards dimensions, in some respect. The boxes must be made to fit the spaces in which they will be placed. In new work the reverse is true; a space is made to fit the box.

the partition (Fig. 30) with wood screws and is so placed that its outer edge is nearly flush with the surface of the plastered wall.

The trim, Fig. 32, is made of such dimensions that the barrier forms a stop for the door if the box has a gutter. If no gutter is provided the sides and ends of the box form the door stop. The sides of the trim should extend about 6 in. beyond the sides of the box to cover broken plaster and insure a neat appearance. The latch and hinges should be made of brass and the door should be paneled to prevent warping. The trim is held to the box with round-head wood screws.

An alcohol torch is best for soldering connections in the wiring of old houses, for the reason that the wireman can solder each joint as he makes it and thus make sure that none are left unsoldered. A gasoline blow-torch is not good for the work because it requires too long to place it in commission and the flame is so intense that there is constant danger of fire from ignited dust or chips falling into partitions. Satisfactory work can be done with a soldering copper heated by a blow-torch or a gas stove, but it is not feasible always to keep it in readiness for immediate use. Fig. 33 shows an alcohol torch of satisfactory design which costs about a dollar. Wood alcohol, purchasable at any drug-store, is the fuel. It is possible, using wire solder, to make

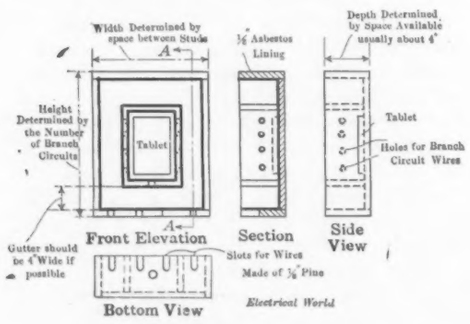



Fig. 31—Details of Panel Box.

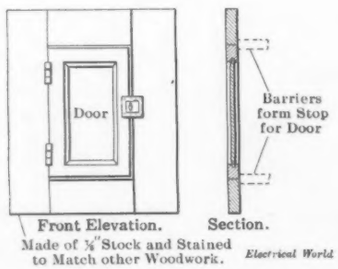



Fig. 32—Details of Panel-Box Trim.

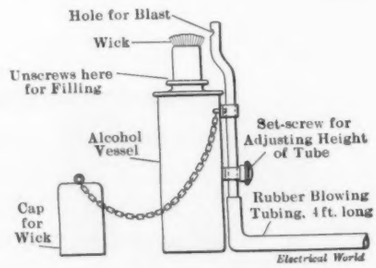



Fig. 33—A Satisfactory Type of Alcohol Torch.

a soldered splice in conductors as large as No. 4 B. & S. gage with a torch like that shown in Fig. 33. As a general thing an alcohol torch is not satisfactory for conductors larger than No. 6, and then a gasoline blow-torch must be used. With an alcohol torch it is not necessary to use the air blast for small wires, but with larger sizes the hot flame needed can be obtained by blowing through the rubber tube. The blow-pipe tube can be adjusted vertically to compensate for the burning away of the wick and to change the size of the blast flame.

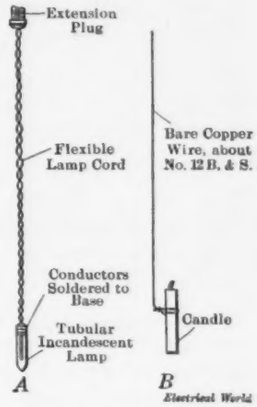


Fig. 34—Exploring Lamp.

Fig. 34 shows a home-made exploring lamp which is useful in wiring old houses. The device shown at *A* is a tubular incandescent lamp soldered to the end of a length of flexible cord, while the one at *B* is merely a candle attached to a length of copper wire. Obviously the form shown at *A* is useful only in houses where a source of electrical energy is available. The exploring lamps are useful in "fishing" and in boring holes through remote obstructions. Such a lamp can be lowered into a partition through a bored hole, for example, to illuminate the space in which the wireman is fishing.

This concludes the description of the business policies and construction methods employed by the Allegheny County Light Company in connection with wiring old houses. The author desires to acknowledge the courtesy of Mr. R. S. Orr, general superintendent of the company; Mr. H. H. Wood, superintendent of the wiring department, and Mr. J. J. Davis, wiring foreman, for permission to describe the company's methods. Mr. Orr early appreciated the possibilities of a wiring department as a means of increasing the business. Such a department was formed by expanding the lamp-renewal department, so that it now has charge of the installation interior wiring, electric signs and flaming-arc lamps. There is one permanent estimator and others are secured from the wiring force as needed. The department now employs about fifty persons.

## APPARATUS FOR MEASURING LIGHT AND ILLUMINATION.

By J. S. Dow and V. H. Mackinney.

In a recent paper before the Optical Convention in London the authors dealt with some recent advances in the measurement of light and illumination. It was pointed out that the chief element of progress during recent years has been not so much the growing accuracy and precision of measurements in the laboratory, although great advances in this direction have doubtless been made. The most striking change has been the popularization of light measurements and the design of more convenient and simpler forms of instruments. At one time photometry was carried out only in the laboratory. Subsequently measurements of street-lamps were carried out by means of traveling carriages. At a still later stage truly portable apparatus, capable of being carried in the hand from place to place, came upon the scene.

A street-lamp photometer should be compact and portable, capable of being carried in the streets with the same ease as a small hand camera, should be rapidly and easily manipulated, sufficiently accurate for practical purposes and readily set right if the reading for any reason should vary in the course of time. In order to secure these advantages a certain concession as regards extreme accuracy may well be made, and for the majority of practical purposes an accuracy of from 5 to 10 per cent would be ample, while in some circumstances an even greater range might be permissible.

As an illlustration of the work which can be done with such instruments reference may be made to the large number of data obtained in schools, libraries, workshops, etc.,

Fig. 1—New Model of Lumeter.

with the Holophane lumeter instrument, as described at meetings of the (British) Illuminating Engineering Society. The instrument can be used to measure not only illumination, but also surface brightness. The general appearance of the instrument (which is only 5¾ in. by 4½ in. by 1¾ in.) is shown in Fig. 1 and the details are shown in Fig. 2.

The small lamp *B* is inclosed in a cylindrical chamber, whitened inside and uniformly illuminating the rectangular aperture *G*, which is covered by a ground opal-glass plate. This plate in turn acts as a source of light and illuminates the photometric screen *C*. The lid *A* is attached to a cylinder fitting concentrically round the chamber and having cut in it an aperture of spherical shape. As the pointer *H* is revolved this adjustable shutter covers the source *G* to a greater or less extent and varies the illumination of the photometric screen *C* accordingly. By moving the pointer across the scale the illumination is reduced uniformly from 2 ft.-candles (with the aperture fully open) to 0.2 ft.-candle and then to zero.

In using the instrument the observer points it at the surface the brightness of which he wishes to study and places his eye at *E*, at the same time pressing the contact at the base of the instrument and lighting the lamp. He then sees through the central aperture *D* in the illuminated surface *C* the surface to be tested and adjusts the pointer until photometric balance is secured. The reading can then be observed on the scale in foot-candles. The construction of *C* deserves a word or two of explanation. It is made by covering a glass surface with a very fine white emulsion, scraping away the center and then protecting by a cover

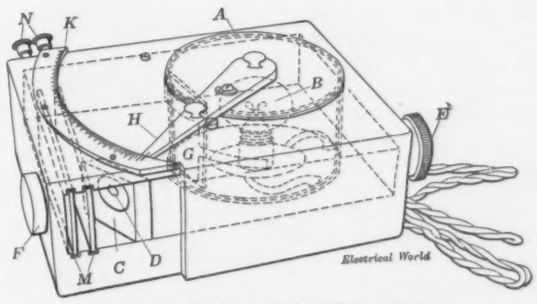


Fig. 2—Working Parts of Lumeter.

glass. In this way there is constructed a screen which cannot be soiled or scratched by contact with the fingers, and, the emulsion being very thin, an exceedingly fine line of photometric division is obtained.

In order to increase the range of the instrument recourse is had to two dark glasses (shown at *M*), reducing the light to 0.1 and 0.01 respectively. These can be placed in the

path of the rays of the object studied by pulling out the knobs *N*. By this means the reading can be multiplied by 10, 100 or 1000, so that values up to 2000 ft.-candles can be measured. The choice of a suitable glass which is sufficiently opaque, uniform and neutral for the purpose naturally demands some care. The most recent variety adopted has proved to have very good qualities in this respect.

The small lamp used in the instrument receives energy from a 4-volt storage battery packed in the case of the instrument, and the whole can be carried about as easily as a small hand camera. The instrument can be set to read correctly, by reference to a given illumination, by simply adjusting the position of the lamp slightly. When measurements of illumination, as distinct from surface brightness, are to be made all that is necessary is to observe the brightness of a standard mat celluloid screen supplied with the instrument, and this is also used in calibration. The advantages of being able to measure either surface brightness or illumination, and of having for the latter purpose a detachable standard white surface, have been appreciated by Dr. C. H. Sharp and Mr. P. S. Millar in the United States, and this principle is embodied in their well-known instrument.

The experience of the authors in Great Britain shows that measurements of illumination are of great value to the lighting engineer in enabling him to demonstrate to consumers the change in illumination resulting from an improved form of lighting appliance and in comparing the results with various types of shades and reflectors. Reference has been made above to the measurements carried out in schools, libraries, etc., and quite recently a very large number of measurements with the Holophane lumeter have been carried out by the Home Office in various factories.

In the literature of illuminating engineering it is now becoming customary to present measurements of the illumination, but in many cases, notably in discussing indirect lighting installations, it is really desirable also to include data about the brightness of surroundings. This is very desirable in comparing different systems and ascertaining to what the impression of "monotony" sometimes complained of is due. Moreover, surface brightness may be measured in many cases in which only relative results are required; for example, in studying the distribution of light over an illuminated sign, etc. One other form of measurement which may be of value soon is the estimate of the brightness of illuminated shades and globes with a view to ascertaining whether this is within the prescribed value to avoid glare. With the lumeter here described a brightness of 2000 ft.-candles can be measured direct, and with a little adjustment a value of even 5000 or 10,000 might doubtless be measured. The latter figure is equivalent to about 20 cp per square inch and is therefore well above the minimum brightness advocated by many authorities by analogy with the brightness of the sky (about 2.5 cp per square inch). The high range is also desirable when dealing with daylight values. On the other hand, the brightness of the night sky (often about 0.005 ft.-candle) is also measurable. For certain feebly lighted surfaces such as are encountered in some lines of work the low range of the instrument is very advantageous, and it has been suggested that measurements of the sky brightness at night, of the brilliancy of stars and comets, etc., would be of service to astronomers. In a very interesting series of measurements made during the solar eclipse of April 17 of this year it was shown that the illumination at totality was only about 8 per cent of that before the eclipse began, almost exactly proportional to the percentage area of the sun's disk obscured.

The facility to measure illumination and surface brightness also enables one to determine reflecting power and absorption very easily. For example, the reflecting power of the screen used in cinematograph displays is a matter of some consequence, and by employing a silvered or powdered aluminum screen a marked concentration in brightness in certain directions can be secured. Such screens can, however, be conveniently used only in long narrow rooms in which none of the audience view the screen very obliquely. The data on wall-papers in the accompanying table may also be of interest.

REFLECTING POWER OF WALL-PAPERS, FROM ACTUAL RESULTS OBTAINED IN ROOMS LIGHTED BY TUNGSTEN LAMPS.

| Nature of Room. | Paper. | Surface Brightness (Foot-candles). | Illumination (Foot-candles). | Reflection, Per Cent. |
|---|---|---|---|---|
| Drawing-room..... | Light blue. | 0.30 | 0.72 | 40.0 |
| Hall..... | Dark red. | 0.15 | 0.60 | 25.0 |
| Library..... | Deep green. | 0.15 | 1.00 | 15.0 |
| Dining-room..... | Very deep blue. | 0.015 | 0.35 | 4.5 |

It may be mentioned in passing that as a result of experiments in many different schools, libraries and private houses a surface brightness of 0.3 ft.-candle seems to be about what is usually needed to give a room a cheerful appearance. In some cases, however (for example, in a library), a more subdued effect is preferred, and walls with a surface brightness of only 0.1 ft.-candle may be found.

The reflecting power of wall-papers has frequently a not inconsiderable effect on the conditions of illumination in rooms lighted by artificial means, and a series of experiments was recently carried out in a small room equipped with various wall-papers in order to ascertain in what respects calculations based on the use of prismatic reflectors and tungsten lamps would have to be modified by this factor. It was found that approximate rules could very readily be derived.

It may be observed that the reflecting power of colored materials depends to some extent on the quality of light by which they are illuminated, and this fact was recently made use of by Mr. T. E. Ritchie[1] as a means of testing the resemblance of various artificial illuminants to daylight. A series of ribbons of delicate shades of color were stretched upon a board and the reflecting power of the series was determined by average daylight. The measurements were repeated by the light of the various illuminants, and Mr. Ritchie found that the closest repetition of daylight values was secured in the case of indirect arc lighting.

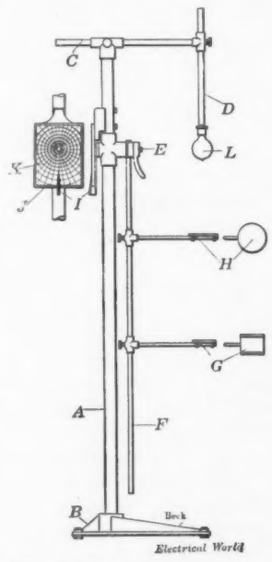



Fig. 3—New Form of Polar Curve Apparatus.

One other very interesting application of measurements of surface brightness is in connection with photography. Of recent years companies interested in illuminating engineering have come to appreciate the value of good photographs of artificially lighted interiors, but it is difficult to secure the exact exposure necessary to bring out the illuminated portions of the room correctly and also to show the actual fixtures. It has been found that photometric measurements of the actual surface brightness of various objects in the room have been exceedingly useful in this

[1] *Illuminating Engineering*, London, February, 1912.

connection, and such measurements can also be applied in many other cases (for example, in very feebly lighted interiors, churches, etc.) in which the use of an "actinometer" is inadmissible. On general grounds, too, it may be suggested that a comparison of the brightness of the objects photographed with the results subsequently obtained would be found extremely valuable to instructors in the art of photography.

Another new piece of apparatus which the authors have designed is that shown in Fig. 3 and is somewhat similar to that worked out independently by Dr. C. H. Sharp in the United States.[2] The apparatus is mounted on a substantial base *B* and the lamp *L* to be tested is attached to an adjustable rod *D*, which can be moved up and down or to and fro.

It is sometimes desirable to suspend the lamp from the ceiling. In any case the lamp is brought central with the point *E* (corresponding with the center of the polar-curve paper shown at *K*). The rod *F* rotates about *E* and carries the standard celluloid surface *G*, the distance of which from the lamp tested can be adjusted. As *F* rotates, therefore, the face of *G* is always presented vertically toward the lamp *L*, and its brightness will be proportional to the candle-power of the lamp in that direction. There is also a pointer *I* rigidly connected with *F*, which rotates with it and indicates on the sheet of polar-curve paper the angle with the vertical which *F* takes up. It may be added that this paper is arranged to be a convenient height (about 5 ft.) from the ground.

The operation of testing the lamp is as follows: A lamp of known candle-power is first placed in position. The standard surface *G* is observed through the lumeter, and its distance on the rod is adjusted until the reading of the instrument is some convenient sub-multiple of the known candle-power in that direction. (For example, if the candle-power were known to be 16, the reading on the instrument might conveniently be 1.6 ft.-candles.) *G* is then clamped in position and the lamp to be tested is constituted for the standard lamp.

The arm *F* is then rotated, the brightness of *G* being noted in each case and the corresponding candle-power marked on the polar curve paper opposite the pointer. The curve is thus traced out at once, while the experiment is in progress, and there is no need for subsequent calculations.

When very great accuracy is not necessary it is also possible to use this apparatus even in rooms which have not black walls and in which there is a certain amount of stray light. Under these conditions use is made of *H*, which is an adjustable black screen and which can be inserted in any convenient position between the lamp and *G*. If, therefore, there is any question of the readings being affected by stray light, a reading is taken first without *H* in position. The brightness of *G* is then proportional to the illumination due to the lamp tested plus the stray light (if any). The screen *H* is then inserted, blocking out the direct light from the lamp tested. The brightness of *G* is now due to stray light only. Hence, by subtracting the latter reading from the former, the true value is obtained; that is, reading without dark screen, reading with dark screen, true candle-power.

The advantages of this method may be summarized as follows:

(1) The rigidity and convenience with which the results are obtained.

(2) The polar candle-power curve is worked out automatically while the experiment is in progress; no calculation is necessary.

(3) The apparatus is simple and portable and can readily be moved from room to room.

(4) Only one observer is needed for the photometric manipulations, and he can make all the observations in one position; it is not necessary to be continually crossing the room to adjust mirrors, etc.

(5) By the use of the special screens provided, the apparatus can be used, in an emergency, in an ordinary room without darkened walls, and allowance can be made for stray light according to the method that has been described above.

It is expected that the apparatus will be most useful for lamps of moderate candle-power (although the fact that the lumeter will read up to 2000 ft.-candles obviously enables very powerful sources to be tested).

In the case of the focusing forms of reflectors one precaution is necessary, namely, to arrange the distance between the illuminated photometrical surface and the source of light to be the same in both cases. Most of those who have done much work in testing reflectors of this kind are aware that the results depend to some extent on the distance at which the tests are made. In the case of a simple light source such as naked incandescent lamps, even though it may not be strictly speaking a point source, practically identical results are obtained whatever the distance of testing, because the inverse-square law applies with reasonable accuracy, but in the case of concentrating reflectors it is desirable to adopt some standard distance of testing, say 10 ft. or 12 ft. In order to provide for this the authors combine with the apparatus shown in Fig. 3 an inclined mirror by the aid of which the beam of light is directed on the standard card some distance away, the brightness of the test card being determined with the lumeter in the usual way.

Yet another new piece of apparatus described in the paper before the Optical Convention for the first time consisted in "a portable standard of light." It utilizes a small tungsten lamp receiving energy from a storage battery packed away in a small portable case. A somewhat novel method of keeping the voltage across the lamp constant is used. A small carbon filament is introduced in parallel with the tungsten standard so that both receive the same voltage. Now, if the voltage varies it will affect both lamps unequally. Between the two lamps is inserted a convenient photometric screen so that this is put out of balance directly any change in the voltage occurs, and this variation therefore becomes visible to the observer. The voltage can be brought back to its correct value by merely adjusting the resistance in series with the lamps until the photometric screen is in balance once more. It is not suggested that this will serve in the same way as the very exact laboratory standards. But it will answer as a convenient means of checking the correctness of illumination photometers and for commercial work and it possesses the advantage of being readily carried about from place to place as required.

In conclusion, the authors point out that there is need for more up-to-date methods of instruction on illumination in colleges and technical institutions. At the present there is a great deal of unnecessary and burdensome calculation and routine work and the apparatus is often of a somewhat antiquated character. All this tends to prejudice the student against photometric experiments. He spends so much time on his tools that he rarely reaches the stage of using them to any extent. What is needed is to avoid needless duplication of work and save time so that experiments on practical applications of illumination can be included. Tests of modern forms of globes, shades and reflectors should be made, as should also experiments in typical interiors with the lamps actually in position. The student should also be familiarized with measurements of illumination. There are many special branches of research work, such as the formation of shadows and the avoidance of excessive contrast and glare, which might well be made the subject of careful investigation by advanced students in the science of illumination.

[2] See Johns Hopkins "Lectures on Illuminating Engineering," 1910.

## RECENT TELEPHONE PATENTS.

One of the simplest of telephone appliances is the receiver, and this has been so long standardized that little change in its construction can be looked for. However, with the common-battery system the receiver must almost always be used in conjunction with a condenser, and there is always an available current supply for magnetizing purposes. It is not strange therefore that the electromagnet should be suggested to supplant the permanent magnet, and further that the space within the receiver shell thus made available should be used to hold the condenser. This is the foundation of the receiver, shown in section in Fig. 1, which has been patented by Mr. S. G. McMeen. The cut is almost self-explanatory. However, attention should be called to the magnetic shunt washer upon the core and at the base of the flat operating winding. This is of such diameter as to control the field at the diaphragm.

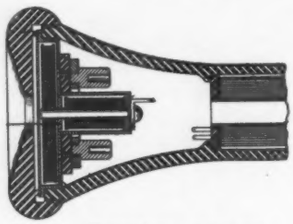


Fig. 1—Telephone Receiver.

Mr. J. F. Barbour, of Elyria, Ohio, has also patented a receiver. His invention relates to the metallic-shell receiver and describes particularly a sheet-metal cap piece which may be secured to the shell by studs engaging bayonet slots instead of by the usual threaded engagement. The patent is assigned to the Dean Electric Company.

### EXCHANGE CIRCUITS.

A common-battery switchboard circuit system has been patented by Mr. D. L. Temple, of Lewistown, Pa., the patent being assigned to the Stromberg-Carlson Company. The most notable feature is the use of a repeating-coil relay for associating the line and jack circuits. Each set of line jacks terminates upon two windings of the relay and each subscriber line is connected to the other two windings. The windings are grouped in pairs at their other ends and connected to battery. This inductive relation is the only connection between line and pack circuits.

Mr. E. E. Clement has also invented a circuit system applicable to either two-wire or three-wire jack circuits. He uses the cut-off relay as the battery-feed retardation coil for one side of the line and a single supervising relay as the feed coil for the second side. The supervisory lamp finds its circuit through the back contacts of the supervisory relay and thence through one side of the talking circuit. This is best understood from Fig. 2. It will be noted that in the two-wire circuit at the right the line relay current for signaling must be insufficient to operate the cut-off relay through which it passes.

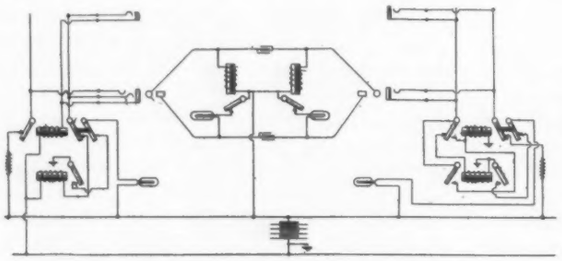


Fig. 2—Telephone Exchange System.

A reverting busy test arrangement forms the chief feature of the automatic exchange system for which a patent has been granted to Mr. J. L. Wright, of Washington, D. C. In this case the object is to cause the busy relay to fail in case the test is to the calling line. This is accomplished by arranging that the calling line shall have its test contact connected to the same pole of the battery during the test period as is the test relay. The relay fails therefore. The normal line has the opposite condition at the test period. This patent is assigned to the North Electric Company.

Mr. O. M. Leich has patented a trunk circuit for use between a magneto and a common-battery exchange. The trunk ends in a jack at the common-battery end and a plug at the magneto end. For calls originating at the latter the trunk calling signal, a lamp, glows upon connection of the trunk plug to the calling line. Regular connecting cords are used to respond at the distant end and full supervision is given. For calls the other way a ring on the trunk throws a drop and response is made through a trunk listening key. This patent is assigned to the Cracraft-Leich Electric Company.

The trunk system invented by Mr. F. M. Davis, of Chicago, and assigned to the Kellogg Switchboard & Supply Company, is a two-way trunk with exactly similar and complete signals in both directions.

# Letter to the Editors

## RESIDENCE RATES.

*To the Editors of the Electrical World:*

Sirs:—The letter on residence rates by Mr. H. G. Briggs in your issue of Aug. 10 takes rather a comfortable view of the problem and calmly proposes to charge the residence consumer a flat meter rate, regardless of demand or consumption. But why disregard the connected load? There surely is nothing illegal about a rate which takes the last factor into consideration, because it has been customary for many years to make rates for water service based on the number of faucets or outlets. Fundamentally there are three service elements, in the demands of any customer, in which the central station is vitally interested, namely, the maximum demand, the time of day when this demand is made, and the total consumption of energy.

One of the most serious problems is how to reduce the meter investment in residence installations—hence the practice developed in Wisconsin of using the average ratio of demand to connected load from a long series of tests as a substitute for the maximum-demand meter. A still later proposal is the use of an ampere-hour meter in place of the watt-hour meter, to reduce the meter costs.

But why the residence consumer ought not to have the benefit of quantity discounts is by no means clear. To be sure, the monthly average consumption is low, but the application of averages to a large class is likely to work injustice. The consumption in many residences of the better class is more than 15 kw-hr., and probably it will increase with more widespread use of domestic heating, cooking and motor-driven appliances. Simplicity in rate schedules is highly desirable, but it isn't everything—justice should come first.

What is most needed is a method of rate making which will not assess the small consumer—residence or otherwise—more than his fair share of the costs, nor deny him a just proportion of the benefits which large consumers receive. Compare the residence rates in our large cities like Chicago and New York, about 10 cents per kw-hr., with the low rates prevailing in some Western cities, such as 6 cents per kw-hr., for example, in Seattle, Wash., and 7 cents in Toledo and Columbus, Ohio, and Los Angeles, Cal. Is not the small consumer in the larger cities under a disadvantage?

*Chicago, Ill.* E. C. Anderson.

# Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

### Generators, Motors and Transformers.

*Starting Large Direct-Current Motors Without Series Resistance.*—CARL TRETTIN.—Direct-current motors are generally started with the aid of a series resistance in order to prevent damage by excessive starting currents. The accepted necessity of using a series resistance is considered by the author to be a fallacy. He emphasizes the fact that the self-induction does not permit the starting current at once to assume its full value, but forces it to increase gradually, while the large torque which is proportional to the armature current in pure shunt motors causes a large acceleration and a rapid increase of the counter emf. The author gives the mathematical formulas for the phenomena during the starting period and shows the relation between self-induction, resistance and momentum of inertia of the motor armature. After presenting the theory he illustrates it with numerical examples having special reference to the electric propulsion of ships. According to Huelss, the propelling motors of the ship are connected without starting resistances directly to the source of energy. The author shows that it is possible to start large direct-current motors (that is, with several hundred horse-power capacity) without series resistances, and the tests made and oscillograms given show good agreement with the results of his theory. The article is to be concluded.—*Elek. Zeit.*, July 25, 1912.

*Cascade Connection of Induction Motors and Polyphase Commutator Motors.*—ERNST SIEGEL.—The conclusion of his article on the different systems of cascade connection of a large induction motor with an auxiliary three-phase commutator motor with series characteristics, for the purpose of speed control. After concluding the consideration of the method in which the induction motor and the commutator are mechanically connected, he takes up the system in which the two motors are not mechanically connected but the commutator motor is driven by another auxiliary machine which is electrically connected with the network. The theory of each method is given and the results are illustrated in diagrams. Some notes are added on the design of the commutator motor, relating to the use of a compensated motor or an ordinary series motor with brush displacement.—*Elek. u. Masch.* (Vienna), July 14, 1912.

*Reluctance of Armature Teeth.*—DAVID ROBERTSON.—A description of his graphical method of calculating the reluctance of the teeth of a slotted armature, for those cases in which the flux density is so high that the flux in the slots cannot be neglected. The method is based on the assumption that the same excitation is available for magnetizing the teeth and the slots, which is the same thing as supposing that the lines of flux are straight and radial. The article is illustrated by diagrams.—London *Electrician*, July 26, 1912.

*Voltage Regulators.*—A note on a recent British patent (No. 7220, July 18, 1912) issued to M. Fuss. To keep the terminal pressure of an electrical generator constant, the system of periodically short-circuiting a resistance in the exciter circuit by means of a contact lever operated by the generator and exciter pressures is used. The contact lever is so arranged that it can respond independently to changes in the pressure of both the generator and exciter at the same time. The lever, besides striking the fixed contact, is also subject to alteration in position according to the variations of the two pressures.—London *Elec. Eng'ing*, July 25, 1912.

*Three-Phase Windings for Single-Phase Service.*—W. J. FOSTER.—An illustrated article describing the different methods of connecting three-phase armature windings for single-phase service, and also the Hobart method for taking single-phase current from a polyphase armature by means of a transformer.—*Gen. Elec. Review*, July, 1912.

### Lamps and Lighting.

*Tungsten Wire Filaments.*—A note on a recent British patent (No. 27,360, July 4, 1912) of O. Krause. To draw wires finer than 0.001 in. diameter, a compact body of tungsten is treated mechanically while hot to destroy its crystalline structure. It is then drawn or rolled to a gage as small as possible and afterward receives a chemical or electrochemical treatment which removes a further appreciable portion of the metal. An alkaline solution of potassium ferricyanide is especially recommended, the wires being passed through the bath at a slow constant speed. The wire forming the anode may be passed repeatedly over rollers in an electrolytic bath of caustic alkali or ammonia (varying in strength from 1 to 30 per cent) at a speed of about 3 ft. per minute. The container forms the cathode.—London *Elec. Engineering*, July 11, 1912.

*Illumination Problems.*—C. E. CLEWELL.—An article illustrated by diagrams describing the method of working out an illumination problem step by step, selecting the type of lamp, size of lamp, spacing distance and mounting height, and calculating the intensity and uniformity of the illumination obtained. The method is illustrated by application to a practical problem, namely, the lighting of a factory.—*Elec. Journal*, July 1912.

*Flame-Arc Lamps.*—W. HECHLER.—An English translation of his German paper recently abstracted in the *Digest* on the status of modern flame-arc lamps and on future possibilities of flame-arc lamp electrodes.—London *Electrician*, July 26, 1912.

### Generation, Transmission and Distribution.

*Hydroelectric Stations in Baden.*—EMIL FREY.—A report presented to the Association of Manufacturers in southwestern Germany on the proposed hydroelectric developments in the Grandduchy of Baden. All water-power plants require a very large investment and there are some which are not particularly prosperous. It is considered unusual that the water-power plant at Rheinfelden, which now has been in service seventeen years, showed better financial returns during recent years. Nevertheless, the author thinks that the gradual development of the larger water-powers of Baden would be advantageous for the future, that is, for the coming generation. As to municipal versus private ownership, the author thinks it is questionable whether municipal plants sell energy at a lower rate than privately owned plants. In Switzerland privately owned stations have been taken over by the government and the tariff has been raised simultaneously. The chief ends desired are the development of all suitable water-powers and the protection of the people's interests. The author concludes with a review of tariffs of water-power stations.—*Elek. Zeit.*, July 25, 1912.

*Mixed-Pressure Turbines.*—An article by R. C. Muir discusses methods of operating mixed-pressure turbines with engines driving mechanical loads. The article describes two methods of balancing the load between the turbine and the engine which may be employed in cases where high economy is of importance, i. e., where it is necessary to insure that no exhaust steam is wasted and live steam is used in the turbine only on overloads. An article by E. J. Best describes the mixed-pressure turbine installation of the Tennessee Coal, Iron & Railroad Company, which is the largest installation of mixed-pressure turbo-generators for the utilization of exhaust steam from rolling-mill engines. An article by E. G. Morgan describes a mixed-pressure turbine installation for traction service where a large increase in station capacity has been obtained without any increase

in boiler equipment. Most of the load was supplied by traction service and a steadily growing peak demanded additional generators. Several alternatives were considered, such as a modern high-pressure turbine and a 5000-kw low-pressure machine with additional boilers. Finally a 2500-kw turbine without boiler additions was decided upon, and the load diagrams show that this scheme was successful. An article by B. E. Semple describes a 7000-kw mixed-pressure Curtis turbine, the largest of its type built to date, installed at the plant of a large steel-manufacturing corporation. It will operate on 140 lb. high pressure or 16 lb. low pressure (vacuum 28½ in.) or both, and under the latter conditions may receive its supply either from three reciprocating engines driving electric generators in the existing power house or from four of the blast-furnace engines. Reference is made to some of the general principles of the control and operation of turbines of this type, and the article concludes with a statement as to the operating economies which have been effected in this particular instance. Considering only the reduction in steam consumption per kilowatt-hour, there is a net saving probably in the neighborhood of $85,000 annually.—*Gen. Elec. Review,* July, 1912.

*Italian Water-Power Plant.*—The conclusion of the illustrated article on the hydroelectric plant of the Adamello Electric Supply Company. The author deals with the construction of the switchboard transmission line and the Sesto, San Giovanni and Pandino transformer substations.—London *Electrician,* July 26, 1912.

**Traction.**

*Hamburg Elevated Railway.*—W. Mattersdorff.—The conclusion of his illustrated article on the Hamburg elevated railway. After concluding his detailed description of the car equipment the author deals with the block-signal, telephone and time systems. The sale of tickets is effected by slot machines in which the tickets are automatically printed. This means a great simplification of the bookkeeping system. Further it means very rapid service, since the time required is simply that needed to drop a coin in the machine and take away the ticket.—*Elek. Zeit.,* July 25, 1912.

*Leeds.*—An abstract of last year's financial account of the municipal tramway system of Leeds, England. The total receipts for the twelve months have increased by $125,000 over the previous year, while the operating expenses have increased only $11,000. The percentage ratio of expenses to receipts for 1911-1912 was 49.96, compared with 52.72 per cent a year ago, and is the lowest figure yet recorded by the system. Experiments have been made with rail-less traction and so far have given complete satisfaction from an operating standpoint.—London *Electrician,* July 26, 1912.

*Electropneumatic Brake.*—W. V. Turner and P. H. Donovan.—The first part of a Franklin Institute paper on the electropneumatic brake system for steam-road service.—*Journal Franklin Institute,* August, 1912.

**Installations, Systems and Appliances.**

*Connections of Electrolytic Rectifying Valves.*—G. E. Bairsto.—A single cell with an aluminum electrode and a lead or nickel electrode permits the current to pass only in one direction, namely, when the aluminum is the cathode. A single cell of this kind is, therefore, suitable as a rectifier of alternating current, but only one-half of the alternating-current wave is utilized. But various connections may be employed, by means of which both half waves may be utilized. Fig. 1 shows the Graetz or Nodon system, in which four rectifying cells *A, B, C, D* are used. The aluminum electrodes are represented by thick straight lines and the lead or nickel electrodes by thin lines. The circuit in which the direct current is obtained is marked "load." This arrangement is simplified in Fig. 2, in which the two cells *C* and *D* of Fig. 1 are replaced by a single cell *C* with two aluminum electrodes. A further simplification due to Siemens is shown in Fig. 3. The negative half wave of emf is able to send current through *A* and the load in the direction of the arrow, but no current will flow through *B*. The aluminum film on *B,* however, receives an electrostatic charge. During the positive half wave *A* is unable to transmit current, but *B* now discharges through the load, the current taking, as before, the direction of the arrow. The result is the establishment of a direct current through the load. This arrangement can, however, be simplified still

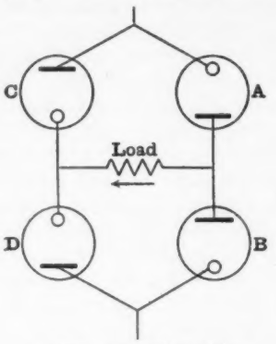


Fig. 1—Graetz-Nodon Grouping.

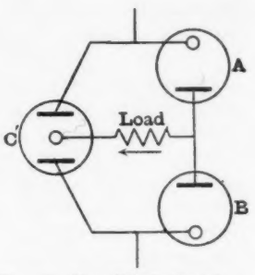


Fig. 2—Simplified Graetz-Nodon Grouping.

further, only one cell being used, as shown in Fig. 4. *A* is a small aluminum electrode corresponding to *A* in Fig. 3, and *B* a much larger one corresponding to discharging anode *B*. This arrangement performs exactly the same operations as that of Fig. 3 and may easily be extended to the rectification of polyphase currents. To rectify two-phase currents two small anodes are required, one for each phase (1 and 2, Fig. 5), and a large discharging anode for the middle wire 3.

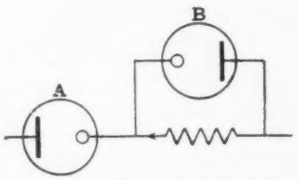


Fig. 3—Siemens Grouping.

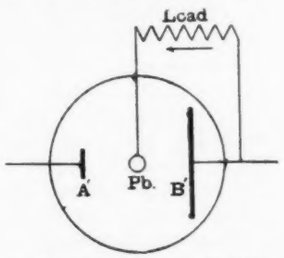


Fig. 4—Single-Phase Rectifier.

For three-phase currents two small anodes are used on two of the phases and a large anode for the third phase, or three small anodes can be used, one for each phase and a large one for the neutral. The latter method, of course, is not an ideal one to employ. Some results are given, in diagrams, of tests on the single-phase rectifier arrangement of Fig. 4. —London *Electrician,* July 26, 1912.

*Charging Storage Batteries Without a Booster.*—R. Edler.—To charge a storage battery directly from the sup-

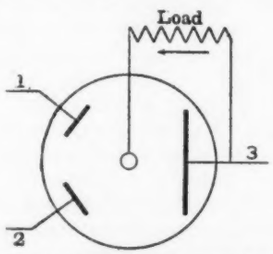


Fig. 5—Two-Phase Rectifier or Unsymmetrical Three-Phase Rectifier.

ply network without a booster, it may be divided into three parts, Nos. 1, 2 and 3, and may then be charged in three periods: First, 1 and 2 in series with each other and a resistance; second, 1 and 3 in series with each other and a resistance, and third, 2 and 3 in series with each other and a resistance. For discharge the three parts 1, 2 and 3 are then connected in series. Or the charging may be carried

out only in two periods: First, groups 1 and 2 are connected in parallel with each other and in series with group 3 and a resistance, and charged until group 3 is fully charged; while in the succeeding step groups 1 and 2 are connected in series with each other and a resistance and are fully charged. The author has previously described an arrangement for the latter system requiring only two switches, which is so simple that no mistakes can be made. He now describes the same system in detail, making use of the method of notation for connections due to R. Lischke.—*Elek. u. Masch.* (Vienna), July 14 and 21, 1912.

*Protective Apparatus.*—E. E. F. CREIGHTON.—A second article on recent developments in protective apparatus. The author discusses the application of the direct-current aluminum arrester to the protection of traction motors, first, when connected directly to the trolley, and second, when used with a series gap of the aluminum type. Changes in the magnetic blow-out type of arrester, necessitated by the increase in potential from 600 volts to 1200 volts, are enumerated and a few remarks included on the selection of arresters for various conditions of service. The results of some investigations on internal resonance of transformer coils are also given, which show that this phenomenon is responsible for many breakdowns that operating engineers have been prone to attribute to defects in material or design. The article is concluded with a description of a registering device which may be made to record in type practically every switching or other operation performed in the power station, or which may be applied to the study of lightning and other transient phenomena along transmission lines.—*Gen. Elec. Review,* July, 1912.

*Insulator Design.*—W. FELLENBERG.—The conclusion of his very long illustrated article on the principles of insulator design. The results of tests of numerous types are summarized in the form of a diagram which gives the principal construction data and the values of the electrical properties as functions of the voltage, from 1000 volts to 200,000 volts. The factors which must be taken into consideration in the design are reviewed.—*Elek. Zeit.,* July 4, 1912.

*Erection of Large Steam-Electric Stations.*—C. KLINGENBERG.—A continuation of his long illustrated paper on the general principles to be followed in the design of large electric stations operated by steam. After discussing the arrangement of the generating units in the turbine room, the author takes up the equipment of the boiler house and the storage and handling of coal.—*Elek. Zeit.,* July 25, 1912.

*Synchronous Condensers.*—C. T. MOSMAN.—An article enumerating the various respects in which low power-factor reacts harmfully on the economy of the system. It is explained theoretically how synchronous motors may be used to control the power-factor by adding wattless current (leading or lagging) to the circuit. A table of sines, cosines and tangents is shown, and the author explains how to use it for resolving a current into its components and determining what condenser capacity is required to produce any desired correction. The same ground is covered diagrammatically, and the two methods are applied to actual examples. The article concludes with a discussion of the questions affecting the feasibility and expediency of employing this method of power-factor correction.—*Gen. Elec. Review,* July, 1912.

### Wires, Wiring and Conduits.

*Standardization of Non-Insulated Conductor Wires.*—W. VON MOELLENDORF.—The author emphasizes the disadvantages of the lack of standardization of conductor wires which now characterizes European specifications. He proposes to consider as standard materials for non-insulated conductors hard-drawn wires of copper bronze and "hard aluminum." Normal conductors of copper and bronze are wires of 1, 1.5, 2, 2.5, 2.8, 3, 3.2 and 3.5 mm diameter (1 mm = 0.039 in.) and cables of 15, 20, 25, 30, 35, 50, 70, 95, 120, 150, 185, 240 and 310 sq. mm cross-section (1 sq. mm = 0.00155 sq. in.). Standard aluminum and aluminum alloy wires have the same dimensions, but aluminum wires of less than 2.5 mm (0.0975 in.) diameter are not permitted.—*Elek. Zeit.,* June 27, 1912.

### Electrophysics and Magnetism.

*Hysteresis Loss as Affected by Previous Magnetic History.*—E. WILSON, B. C. CLAYTON AND A. E. POWER.—A British Physical Society paper on the hysteresis loss in iron at atmospheric and liquid-air temperatures under three different conditions—(1) after the iron has been carefully demagnetized, (2) after it has been subjected to a large force (previous history) of about 26 c. g. s. units, and (3) while it is under the influence of an external constant magnetizing force after demagnetization. One object is to discover (a) how the dissipation of energy varies in the above cases when the maximum magnetic induction $B$ is the same in each, and (b) how it varies in cases (2) and (3) when not only the maximum magnetic induction is the same but the value of the reversal force $H$ is the same. This matter should concern any molecular theory of magnetism. It is shown both at atmospheric and liquid-air temperatures that the loss for a given value of the magnetic induction $B$ is greater in case (2) than in either (1) or (3) and that the loss in case (3) is greater than in case (1). Moreover, the loss at liquid-air temperature is for corresponding cases greater than at atmospheric temperature. For given values of the magnetic induction where the reversal force $H$ and the temperature are the same for each, the loss in case (2) is greater than in case (3), and the percentage difference between the losses rises to a maximum of about 20 when $H$ has a value of about 0.5 c. g. s. units in stalloy. This percentage difference has about the same maximum, with about the same value of reversal force $H$, at both atmospheric and liquid-air temperatures. As regards the importance of the subject to engineers, it may be mentioned that the watts dissipated by magnetic hysteresis may be increased by as much as 45 per cent, and the magnetizing force 85 per cent, in comparison with values obtainable when the effects of previous magnetic treatment have been wiped out. It would seem, therefore, that after severe short-circuits it may pay to demagnetize the cores of transformers, static balancers, etc. In the discussion C. Lees asked if the effects due to the previous history would not disappear after the alternating-current service had been resumed for a time. E. Wilson replied that, although the alternating current had been applied to the specimen for an hour or more during the tests, it would not wipe out the effect of a previous field that was more intense than its own. In order to demagnetize the specimen by alternating current the current must be large enough to produce a magnetization more intense than any previously experienced, and then gradually must be reduced to zero.—London *Electrician,* July 19, 1912.

*Hysteresis Loss.*—F. STROUDE.—His complete British Physical Society paper, an abstract of which has already appeared in the *Digest,* in which a series of careful determinations of the hysteresis loss in transformer iron, cast iron and stalloy are described. The method employed was that of the "uniformly varying flux." A set of hysteresis measurements by a ballistic method is also included, the results obtained being compared with those from "slow cyclic" tests. The values for the losses are reduced to the form of the Steinmetz law $W_h = \eta B^e$, and it is shown that for each material the index $e$ is sensibly constant over a fairly wide range of $B$, but the value differs considerably for different materials (cast iron $e = 1.8$, transformer iron $e = 1.7$, stalloy $e = 1.66$).—London *Electrician,* July 19, 1912.

*Roentgen Radiation from Substance of Low Atomic Weight.*—C. A. SADLER AND P. MESHAM.—An account of experiments in which it is shown that a homogeneous beam of Roentgen rays when scattered by a substance of low atomic weight is transformed into a softer type of radiation.

The harder the exciting beam the greater is the intensity of the scattered radiation. The harder the exciting beam the more profound is the change in its quality.—*Phil. Mag.*, July, 1912.

*Interferometry of Air-Carrying Electrical Current.*—Carl Barnes.—An account of experiments made to investigate whether a rarefied column of air through which a current of electricity is flowing shows any perceptible change of its index of refraction. So far the results are negative.—*American Journal of Science*, August, 1912.

*New Rays.*—G. Ribaud.—A paper on the appearance of new rays in a Geissler bromine tube when placed in a magnetic field.—*La Lumière Elec.*, July 6, 1912.

*Rotations in the Metallic Arc.*—W. G. Cady.—An abstract of a Physical Society paper on rotations observed at the anode of an iron arc in air.—*Physical Review*, July, 1912.

**Electrochemistry and Batteries.**

*Electric Laboratory Furnace.*—D. F. Calhane and E. E. Bard.—A detailed illustrated description of a simple electric furnace rated at 1 kw or less which is useful for many purposes in the laboratory. The design and construction are described in detail.—*Met. and Chem. Eng'ing*, August, 1912.

*Laboratory Furnace.*—An illustrated description of an "electric transformer crucible furnace" of German make. Each furnace unit is a combination of a transformer with a carbon crucible. The crucible itself forms the resistor. The secondary terminals of the transformer are connected by flexible copper conductors with two water-cooled contacts gripping the crucible, so that the secondary current from the transformer passes through the crucible and heats it.—*Met. and Chem. Eng'ing*, August, 1912.

**Units, Measurements and Instruments.**

*Measuring Self-Induction and Capacity of Antennas.*—A. Esau.—For determining the capacity and self-induction of antennas three methods are in use. The first is based on the shortening of the wave-length by insertion of a capacity, the second depends on the lengthening of the wave-length by insertion of a reactance coil, and the third relies on the change of the damping coefficient due to the insertion of a resistance. The author compares the three methods in detail. With respect to accuracy and speed the third method is inferior to the other two. An accuracy of 1 or 2 per cent could easily be obtained in the first two methods. But it is important to insert the capacity, or the self-induction coil, as exactly as possible at the node, and to exercise care that the wave-length is not shortened or lengthened by more than 20 or 25 per cent.—*Phys. Zeit.*, July 15, 1912.

*Sensitive Selenium Cell.*—W. S. Gripenberg.—The author shows that the increase of conductivity of a plate of crystalline selenium due to illumination can be made to reach as much as 1000 times the conductivity in darkness if the thickness of the plate is of the order of magnitude of 100 μμ. He describes how to produce such thin selenium layers.—*Phys. Zeit.*, July 15, 1912.

*Meters.*—An official announcement of the Reichsanstalt admitting for calibration a single-phase induction meter of the Siemens Schuckert Company, a direct-current magnet motor meter, and a meter with double-counting mechanism of the same company.—*Elek. Zeit.*, July 25, 1912.

*Oscillograph.*—H. Busch.—A mathematical paper in which the author shows how the Blondell-Ortich theory of the oscillograph can be derived in a new and very simple way.—*Phys. Zeit.*, July 1, 1912.

**Miscellaneous.**

*Electric Riveter.*—A note on an electrical riveter of Karl Flohr, shown in section in Fig. 6. The armature *a* of the motor, which is pivoted at *b*, can be coupled to the shaft *c*, which is threaded to fit the swiveled nut *i*; the armature runs continuously in one direction, and the coupling is effected by a magnetic clutch in the flywheel, which is controlled either by the lever *e* or automatically by the contacts *g*, *h*, which actuate the circuit breaker *f* and are adjusted so that the armature is unclutched before the die touches the rivet. The closing of the rivet is effected, therefore, by the momentum of the flywheel on the screw-shaft *c*; at the same time a spring on the end of the shaft *c* is compressed and serves to return the nut *i* to position after the operation. The die-head is pivoted to the lever which carries the nut

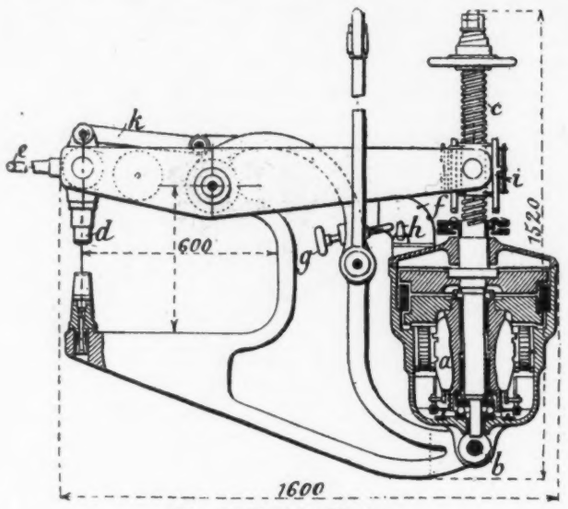



Fig. 6—Electric Riveter.

and to a rod *k*, which maintains the die always in alignment. The machine weighs about 1200 kg, and is suspended from a crane by a swivel at its center of gravity, so that it can easily be manipulated by one man, with the handle *e*.—London *Elec. Review*, July 26, 1912.

# Book Reviews

The Modern Locomotive. By C. Edgar Allen, A. M. I. Mech. E., A. M. I. E. E. Cambridge, England. New York: G. P. Putnam's Sons. 171 pages, 36 illus. Price, 40 cents net.

This is a small volume on English locomotive practice, outlining the more general principles in design and operation, written rather for those who seek to be informed on broad fundamentals than for specialists. Much attention has been given to boilers, combustion, superheating, train resistance, running gear and stability. The book might serve very well in a course of light engineering literature or as an introduction to a comprehensive treatment of locomotive engineering.

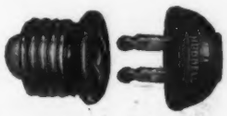
Elektrotechnische Messkunde. By P. B. Arthur Linker. Berlin: Julius Springer. 527 pages, 380 illus.

The second and enlarged edition of a good textbook on electrical measuring instruments, methods of measurement and quantities that frequently require to be measured in electrotechnics. The work has been carefully prepared, is well illustrated and is supplemented with a full list of the symbols employed through the text. It is somewhat unfortunate that the direction of phase advance in the alternating-current diagrams is heterodox, being opposite to that adopted internationally by the International Electrotechnical Commission last year at Turin. It is to be hoped that this discrepancy will be corrected in the next edition. The volume is divided into five main sections, dealing respectively with the following subjects: Electrical measurements, magnetic measurements, direct-current measurements, alternating-current measurements, and photometric measurements. The book will be of considerable interest to students of electrotechnics.

# New Apparatus and Appliances

## DIMINUTIVE SEPARABLE PLUG.

Harvey Hubbell, Inc., Bridgeport, Conn., has placed on the market a small, separable plug applicable for use with table lamps, electric fans and other portable devices used in homes, offices and stores. The plug measures 1⅞ in. from the base end to the cap top, and when inserted in a

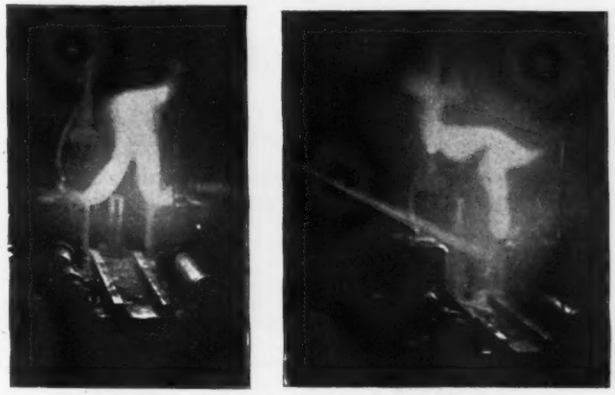


Diminutive Separable Plug.

lamp socket the cap projects a trifle over ½ in. The contacts are embedded in a one-piece porcelain base and the cap is made of black composition. The contact blades in the cap have rounded ends and notched edges which slide into stiff springs in the base. The cap and base come together with a pronounced click, indicating that effective contact has been made. The cap itself is designed to be interchangeable with a line of Hubbell plugs and receptacles, all of which will be smaller than the standard Hubbell plugs, although possessing the same current-carrying capacity. The "push-in" cap does away with the necessity of twisting the flexible cord which oftentimes prevents quick and secure connection. The non-breakable construction of the plug renders it also available for use with electrical apparatus subjected to rough treatment in manufacturing plants.

## EXTINGUISHER FOR ELECTRICAL FIRES.

An extinguisher suitable for all kinds of fires, and especially applicable for electrical fires in that unlike other general fire extinguishers it is a non-conductor of electricity and can be applied with impunity on the commutator of motors or generators while in operation, is manufactured by the Pyrene Manufacturing Company, New York. Pyrene is put up in squirt guns holding 1 quart and is extensively employed in power houses and electric railway cars for



Electric Arc Before and at the Instant Extinguisher Was Applied.

extinguishing fires caused by electricity or other agency. It is a heavy, colorless liquid which volatilizes rapidly and gives off an inert heavy gas that will not support combustion. The charges in the squirt guns can be renewed from time to time. The illustrations shown herewith indicate the action of the liquid, being reproduced from photographs of an arc jumping across a lightning arrester, approximately 6 amp at 2000 volts passing at the time. The arc is said to have been ruptured by a single squirt of the "pyrene" and was re-established again for demonstration purposes by means of a wire attached to a stick. The photograph was taken just as the liquid was applied on the first stroke, the camera recording the phenomenon in a very small fraction of a second, inasmuch as the arc so far as the eye could discern was said to be extinguished instantly. The test was made in the station of the Consolidated Electric Light Company, of Portland, Maine.

## URBAN ELECTRIC TRUCKS.

In the design of the electric trucks known as "Urban" effort has been made to obtain maximum accessibility of parts, maximum convenience of operation and minimum depreciation in service. The speed of the car is controlled

Electric Delivery Wagon

by means of a lever mounted just beneath the steering wheel. This lever operates in the lower slot of a gate for four forward speeds and in the upper slot for two reverse speeds. Before the lever can be moved through the gate in either direction a thumb latch must be operated. The handle cannot by any chance be thrown from forward to reverse position or reverse to forward by accident. The controller handle serves to revolve a tube concentric with the steering column. The controller is operated through a drag-link mechanism. The service brakes, contracting upon the countershaft, are operated by a pedal, and emergency brakes, expanding in drums on rear wheels, are operated by a ratchet-retained hand lever. All control elements are so located as to be manipulated naturally and with little effort on the part of the driver. The controller, lighting and emergency switches, amp-hour meter, wiring terminals, etc., are mounted in the short front shroud which forms part of the chassis. Ready access to all these parts, except the switches, may be had by the removal of an aluminum panel, which closes the rear of this shroud. The switches are mounted on the wood frame which surrounds the removable panel and may be conveniently reached from the driver's seat. The emergency switch is fitted with a key, removable in the off position.

Use is made of a storage cell of either the lead or nickel-iron type. The battery is suspended under the main frame just forward of the counter-shaft. Access to the cells may be had from either side of the car or from the top; the trays

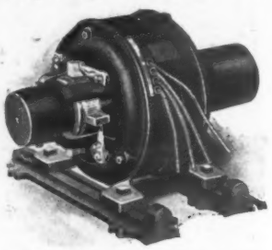
are so proportioned as to permit easy withdrawal from either side of the car.

The trucks are built in four sizes of the same general design, a 1000-lb. delivery wagon, a 2000-lb. truck, a 2-ton truck and a 3.5-ton truck. The rating of the driving motor varies from 28 amp at 60 volts for the lightest wagon to 40 amp at 85 volts. The motor drives a counter-shaft by means of an inverted tooth or silent chain which is inclosed in an oil-tight aluminum housing and operated continually in an oil bath. The large sprocket of this combination is mounted on the flange of the differential gear from which the torque is transmitted through steel shafts to sprockets which drive the rear wheels by means of chains. The counter-shafts are mounted on extremely large annular ball bearings provided with means for copious lubrication.

The Urban trucks have been developed for the market by the Kentucky Wagon Manufacturing Company, Louisville, Ky.

## SMALL SINGLE-PHASE MOTORS.

In small single-phase motors the Advance Electric Company, of 20 North Commercial Street, St. Louis, builds both the double-wound rotor and the automatic short-circuiting types. It is interesting to compare the two. The double-wound rotor provides a higher power-factor than does the short-circuiting type, while the latter has higher initial starting torque. For most classes of constant-speed service there is no choice, so far as the user is concerned, but for the electric-service company the double-wound rotor offers an advantage in using less lagging wattless volt-amperes. Both types, as made by the company named, have interchangeable 110-220-volt leads in sizes of ¼ hp and larger. The sizes made range from ⅛ hp to 5 hp, although frames are also wound for two or three phases in either the squirrel-cage or wound-rotor types and ranging from ¼ hp to 7½ hp in size.



3-hp Single-Phase Motor.

The short-circuiting device was patented eight years ago, but has been improved as the result of experience and is now believed to be a simple and effective mechanism. The Arnold type of repulsion motors provided with it are automatically short-circuited at running speed. The cut shows a 3-hp Advance single-phase motor of the latest type.

## OUTDOOR TRANSFORMER PORTABLE SUBSTATION.

A portable substation of unusual design has been placed in service on the lines of the Scranton & Binghamton Traction Company. The novel features are the use of outdoor-type transformers, the application of Burke horn-type switches and the general arrangement of the lightning protective apparatus.

The 440-kw, three-phase oil-insulated, self-cooling, outdoor-type transformer is wound for 16,500 volts primary and rotary voltage secondary. The high-tension conductors from the line are connected to the Burke horn-type switches, from which they pass through the horn-type fuse and the choke coil and into the primary side of the transformer. A 16,500-volt, 100-amp Burke high-voltage, air-break switch constitutes the high-tension control. The three movable horns of this switch, one in each phase, are connected by bell cranks and may be actuated by a standard oil switch which is arranged for automatic operation and is mounted on the switchboard. The horn switches, however, sever the high-tension circuit automatically in case of overload.

A standard Westinghouse low-equivalent arrester is supported between the transformer and the superstructure on a steel framework bolted to the transformer. An ebony

Fig. 1—Portable Substation.

asbestos wood casing completely incloses the arrester, which is tapped to the high-tension circuit just ahead of the suspension choke coil. From the arrester a lead in which is inserted a series resistor extends to ground. Where the varnished-cambric insulated conductor to the arrester passes through the arrester casing G. & W. potheads are used to provide additional insulation.

A 400,000-circ. mil cable, specially insulated with 7/64-in. varnished cambric and with weatherproof braid, extends from the secondary windings of the transformer to the converter—a 400-kw, 600-volt, 25-cycle, six-phase, 750-

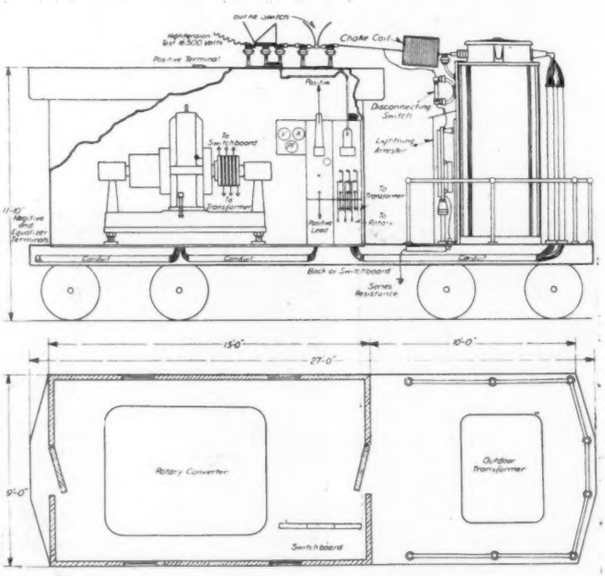



Fig. 2—Section and Plan of Portable Substation.

r.p.m. machine, equipped with an oscillator and an overspeed limit device.

A leveling arrangement is provided by means of which the machine can be accurately aligned when the car is on a grade as great as 4 per cent. There are four blocks of steel, each having one tapped hole through it. One of these blocks is fastened to the car floor under each corner of the converter. Two bolts pass through the converter

bedplate at each corner. One, a holding-down bolt, passes with clearance through the converter bedplate and turns into the tapped hole in the block. The other, a headless stud bolt, turns through another clearance hole in the bedplate; its lower end abuts against the plate, and it has on it, just below the bedplate, a nut. By adjusting this nut the corner of the machine can be raised or lowered as required.

Two 2-in. black slate panels, mounted on an angle-iron structure bolted to the floor and braced to the side wall of the car, with a wing for the instruments, constitute the switchboard. A Westinghouse lightning arrester, supported on the inside of the roof of the car, furnishes lightning protection on the direct-current terminal. For lighting the car there are two five-light clusters which are attached to the car ceiling. One of these is connected to the alternating-current circuit and the other to the direct-current circuit.

All of the apparatus in the substation is of Westinghouse manufacture with the exception of the horn switches and fuses, which were manufactured by the Railway & Industrial Engineering Company, the concern that designed and equipped the car.

## QUARTZ-TUBE MERCURY-VAPOR ARC LAMP.

The quartz-tube mercury-vapor arc lamp now being developed is very simple in design. The arc tube is about 5 in. long, the arc proper being about 4 in. long. When the circuit is closed the shunt solenoid, shown in a vertical position at the top of the lamp, is energized, tilting the tube and causing the mercury cathode to make contact with the anode, receding from it as the tube resumes its normal position and forming a very short arc. The pressure in the tube rises very rapidly, however, and pushes the mercury back into the vertical part of the tube (at the left), permitting the arc to fill nearly the whole of the horizontal part of the tube. The dimensions are so adjusted that when this state is reached the mercury fills its chamber so completely that no further movement of the mercury is possible,

Fig. 1—Quartz-Tube Lamp.

thus allowing the arc to develop perpendicular to the surface of the mercury in the vertical part of the tube. Without this feature of design the cathodic part of the arc would strike the upper surface of the tube, causing it to overheat.

It is claimed that the difficulty of making a vacuum-tight seal for the leading-in wires has been solved so that the problem of the introduction of current is not much more complicated than in the case of an ordinary lead-glass vessel. Instead of a ground joint, tungsten wires are now fused directly into the quartz tube by means of a special seal.

In former designs of quartz lamps two mercury electrodes were used. This arrangement led to serious trouble owing to the fact that the mercury volatilizes at the anode more

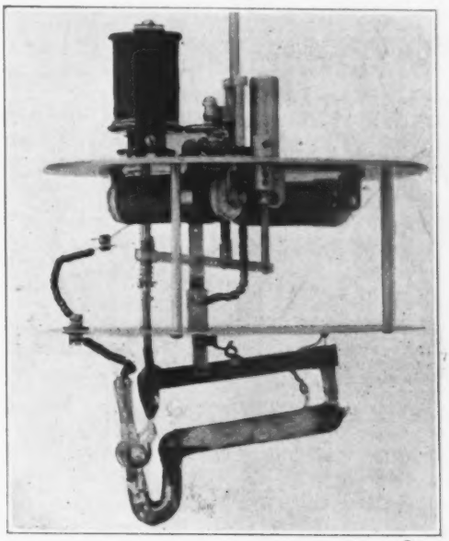


Fig. 2—Mechanism of Quartz-Tube Lamp.

rapidly than at the cathode, thus making it necessary for the mercury to drop back through the arc to equalize the mercury levels at the two electrodes. The problem of equalizing the mercury levels, which led to the use of heat-dissipating devices, such as rows of fins, etc., in the design of the earlier quartz lamps, has been avoided in the newer lamp by the use of a solid anode so that there is only one mercury electrode. The use of a solid anode is said to result in an increase of from 30 to 50 per cent in the efficiency of the lamp, the amount varying but being especially marked in the case of the 110-volt lamp. The use of a tungsten anode eliminates the blacking of the tube while in use.

The quartz-tube mercury-arc lamp has important advantages over the mercury-vapor lamps in which the arc is inclosed in a glass tube. The quartz-tube lamp has about double the efficiency of those that have the arc in a glass tube, owing to the possibility of running the arc at a higher temperature.

A second important advantage results directly from the possibility of energy concentration, as it is possible to use short tubes which will operate on 110-volt and 220-volt direct-current circuits and be of such length that they can be placed inside a glass lamp globe. The shortness of the arc, and hence the small movement necessary to bring the two electrodes into contact by slight tilting, makes possible for this lamp the very simple mechanism shown in the illustrations.

This lamp takes 85 volts across its terminals on a 110-volt circuit and consumes 4 amp. Its candle-power is 700 with a consumption of about 440 watts. Other units with currents down to 1.5 amp can be built.

The specific consumption of the 110-volt lamp across the terminals of the tube is 0.4 watt per spherical candle-power, while, when taking into consideration the loss in the resistor, reflector and globe, the consumption is about 0.6 watt per spherical candle-power. This is superior to the performance of the French and German lamps for 110-volt circuits and about the same as that of their 220-volt lamps; the field for the 110-volt lamp is much larger than that for the 220-volt lamp.

In addition to the lamp with a shunt solenoid mechanism, a lamp with series solenoid mechanism is also being developed. Dr. E. Weintraub, who is developing this lamp in the General Electric Company's research laboratory at West Lynn, Mass., has also developed a vertical lamp of this type. This is said to be an entirely new departure in the design of quartz-tube mercury-vapor arc lamps.

## HANDY TOGGLE BOLT.

A toggle bolt designed especially for the purpose of fastening electrical conduit to plaster walls, ceilings, tiling or any other form of hollow partition has been developed

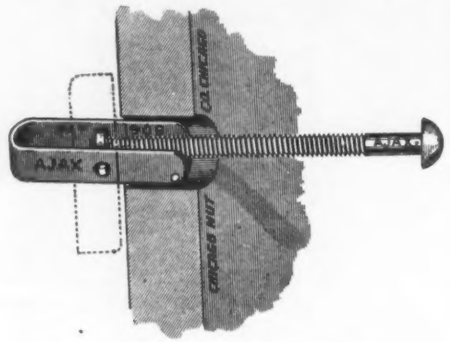



Fig. 1—Toggle Bolt Being Inserted.

by the Chicago Nut Company, Chicago. It is marketed under the trade name "Ajax toggle bolt" and is characterized by several features designed to make conduit installation speedy and economical. As shown by Fig. 1, the toggle bolt may be inserted through a small round hole in a partition in the usual manner. The pivoted nut in the head-piece receives the threaded shank and allows the bolt to be tightened quickly with a screwdriver. In this way the surplus shank is left within the wall instead of protruding, and the time required to cut it off is thus saved.

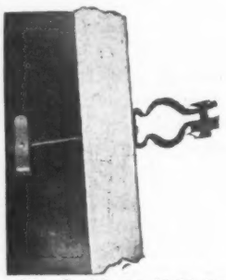


Fig. 2—Clamp Held by Toggle Bolt.

The conduit hanger which is attached to the bolt is readily adjusted and tightened by means of the small bolt shown in the illustration. This company also manufactures a wide variety of toggle bolts for other purposes.

## ELECTRIC FLASHING SIGNS ON DELIVERY WAGONS.

A late development in the use of automobile delivery wagons brings into use not only electric signs but signs showing various colors and combinations by the use of a flasher especially designed for this service by the Reynolds Electric Flasher Manufacturing Company, of Chicago. The spectacle of a moving vehicle made conspicuous after dusk by an electric sign flashing different colors in succession, say, red, white and green, has a unique advertising value. Or the flasher may be made to give changeable effects in almost any variety, as spelling out the sign letter by letter, intermittently appearing trademarks, "chasing" borders, flaming torches, etc. The flasher is compact and strongly built and occupies a space of 8 in. by 8 in. by 6 in. under the driver's seat.

The vehicle shown in the illustration is a gasoline delivery wagon. Electricity is supplied by a generator driven by the engine and operates the lamps in the sign, the motor of the flasher as well as the other lamps used about the vehicle, an electric starting device and the engine ignition. The surplus energy is used to charge a storage battery, which supplies electricity when the engine is not running.

Delivery Wagon with Electric Sign and Flasher.

It is said that a number of flashers to be used on automobiles have been built by the Reynolds company.

## CHART FOR DETERMINING SAGS AND STRESSES IN ALUMINUM SPANS.

The British Aluminum Company, Limited, 109 Queen Victoria Street, London, has developed a universal chart for determining the stresses and deflections in aluminum spans which is both simple and useful. The manufacturer states that the curves given in the chart are based upon the laws of the elastic catenary, assuming further that aluminum has a modulus of elasticity equal to 9,000,000 lb. per square inch, a coefficient of linear expansion of 0.0000130 per 1 deg. Fahr. and a weight of 1.175 lb. for a bar 1 ft. long and 1 sq. in. cross-section. The use of the chart, shown in the accompanying figure, may be explained by means of the following concrete examples:

Assuming constant temperature, the intercept of the ordinate corresponding to a given length of span with the

VALUES OF $q$, FOR ALUMINUM CONDUCTORS.

| Wind Pressure in Pounds per Square Foot | Cross-Section of Conductor in Square Inches. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 0.1 | 0.2 | 0.4 | 0.6 | 0.8 | 1.0 | 1.2 | 1.4 | 1.6 |
| 10 | 1.98 | 1.51 | 1.32 | 1.22 | 1.17 | 1.14 | 1.12 | 1.10 | 1.09 |
| 20 | 3.58 | 2.61 | 1.99 | 1.72 | 1.57 | 1.48 | 1.41 | 1.36 | 1.32 |
| 30 | 5.21 | 3.48 | 2.77 | 2.33 | 2.08 | 1.92 | 1.79 | 1.71 | 1.64 |

curve of desired stress (pounds per square inch) lies also on the curve of corresponding sag or deflection. For example, taking a span of 700 ft. and a unit stress of 10,000 lb. per square inch the intercept lies on the curve which corresponds to a sag of 7.2 ft. Temperature effects are easily cared for, by increasing the vertical ordinate, in case of a rise of temperature, one division for each 10 deg. Fahr. If a rise of 70 deg. Fahr. is assumed in the last example, the sag becomes 11.8 ft. and the tension 6100 lb. per square inch.

Wind pressures are taken into account by means of a factor $q$, which is the ratio of the total load per linear foot to the weight of conductor per foot. If $p$ is the effective wind load per linear foot and $w$ is the weight per foot,

$$q = \frac{\sqrt{w^2 + p^2}}{w}$$

The manufacturer employs a reduction factor of 0.6 in computing the wind pressure on a cylindrical surface from a known or assumed pressure on a normal flat surface of the same projected area. Employing the formula just given and the reduction factor of 0.6, the values of $q$ have been computed, as shown in the accompanying table.

Taking again the example first given and assuming a normal wind pressure of 30 lb. per square foot on a conductor having a cross-section of 0.6 sq. in., the procedure is first to find the value of $q$ from the table, which is 2.33, and then multiply this factor by the span length, which gives $700 \times 2.33 = 1631$. Next take this product, 1631, as the new span length and proceed as before. The new sag is found to be 39 ft., but this value must be divided by the factor 2.33, which gives 16.7 ft. as the correct deflection under the assumed conditions of wind loading, with a unit stress of 10,000 lb. per square inch.

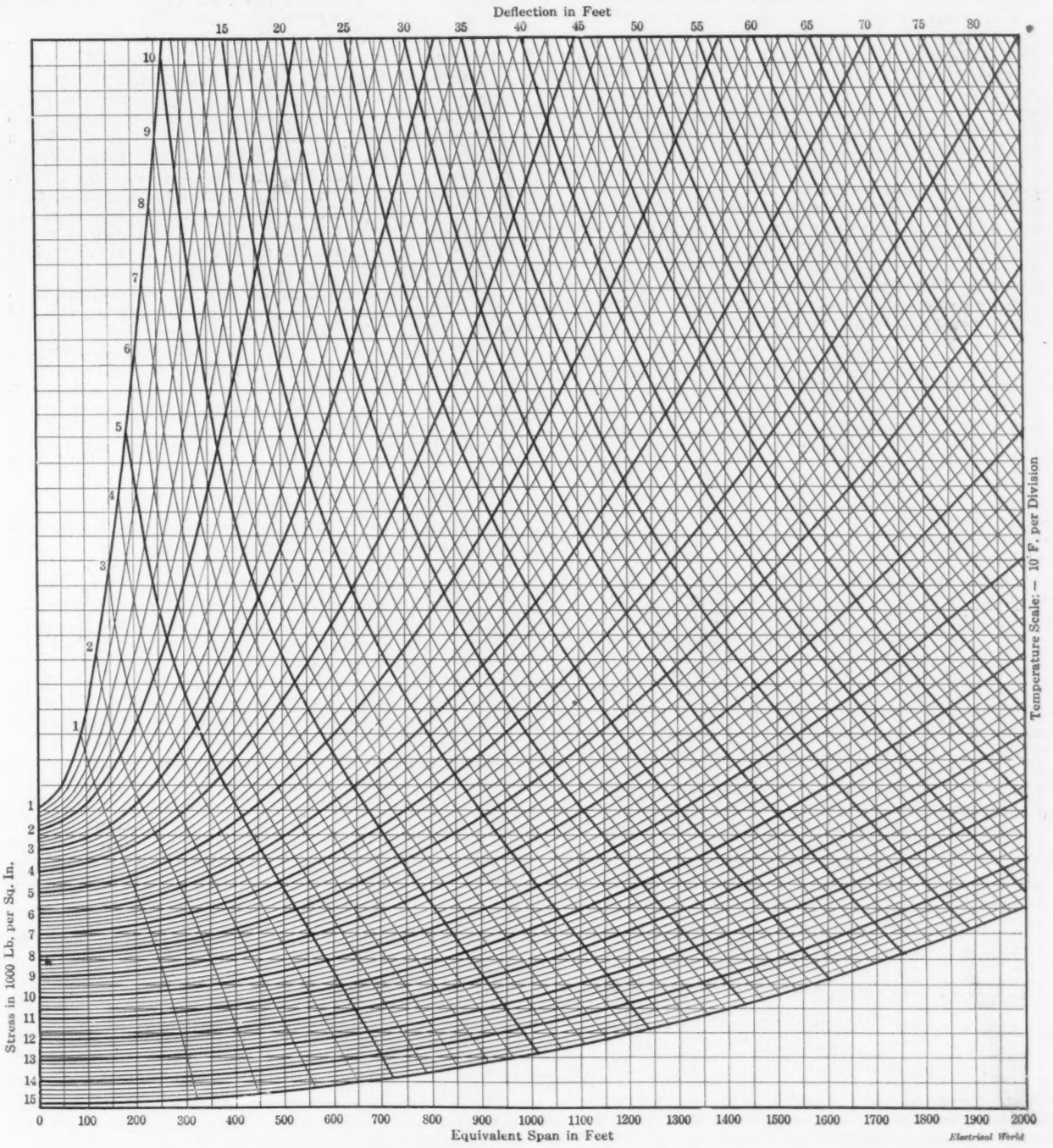



Chart for Determining Sags and Stresses in Aluminum Spans.

The deflection which the span in the last example will assume in still air can be found by following the horizontal line through the point just determined until it intercepts the ordinate corresponding to the true span of 700 ft., which gives a sag of 13.6 ft and a stress of 5300 lb. per square inch. Charts similar to this one for aluminum can be constructed from the theory of the elastic catenary for any other conductor material, such as copper, steel or bronze.

# Industrial and Financial News

EARNINGS of public utilities, excepting those of a few companies scattered here and there, are showing appreciable gains, and the requirements of new business, both prospective and contracted for, are necessitating enlargement and construction of a number of generating stations. Plans are being made by the Minneapolis General Electric Company for developing about 35,000 hp on the St. Croix River. Both the Western Electric and Allis-Chalmers companies report gains in their business. A large hydroelectric development is to be made by the Southern Aluminum Company in North Carolina. Several of the larger companies are about to finance extensions to their systems. Owing to the comparative quietness in the building trade, electrical contractors are finding a large part of their business coming from extensions to existing installations. The price of copper has advanced slightly, but demand is only fair. General business continues to expand uniformly, with improvement in the crops the controlling feature of the situation. Money rates show little change. Rates in New York Aug. 14 were: Call, 2⅛ per cent; ninety days, 4 per cent.

**Byllesby Company Assumes Control of Minneapolis General Electric Property.**—Active management of the Minneapolis General Electric Company, which was purchased from Stone & Webster in May, as noted in these columns May 11 and June 1, was assumed on Aug. 1 by H. M. Byllesby & Company. General George H. Harries, president of the Louisville Gas Company, vice-president of the Consumers' Power Company and vice-president of the Minneapolis General Electric Company, has been assigned general supervision over the property. Samuel Kahn took charge as acting manager to serve temporarily until a permanent manager is appointed. Arthur S. Huey, vice-president of H. M. Byllesby & Company, who personally superintended the transfer of the property, announced that the company would proceed to develop 35,000 hp on the St. Croix River above its present 20,000-hp development at Taylor's Falls, which is to be increased by 5000 hp. He also stated that the company contemplates further hydroelectric development on the Mississippi River amounting to approximately 80,000 hp, completion of which will give a total of nearly 160,000 hp, including several smaller developments, available for use in Minneapolis, St. Paul and the neighboring territory. The properties at Minneapolis and St. Paul will be connected by transmission lines, and the plants of the Consumers' Power Company at Cannon Falls and Mankato will also be joined by a transmission line running south from St. Paul. In January, 1912, the Minneapolis General Electric Company had 16,245 customers and a connected load of 62,245 hp.

**To Improve Adirondack Electric Power Corporation's System.**—Numerous conferences have been held recently between the Public Service Commission for the Second New York District and its engineers and Stone & Webster, who are managers of the Adirondack Electric Power Corporation, in order to determine a basis upon which the properties of the corporation may be placed in first-class condition and interruption to service obviated. Financial and legal difficulties which have taken some time to adjust have delayed the completion of plans as rapidly as expected. The corporation has already spent $75,000 and plans to spend nearly $500,000 more. As noted in these columns April 27, 1912, the corporation was organized under the laws of New York on Dec. 27, 1911, and has taken over the properties of the Hudson River Water Power Companies and its seven affiliated companies.

**Will Build Electric Vehicles.**—The Storage Battery Power Company, 502 Humboldt Savings Bank Building, San Francisco, Cal., has been organized with a capital stock of $100,000 to build Electra storage-battery automobiles for the territory west of the States of Minnesota, Iowa, Missouri, Arkansas and Louisiana, under license issued by the Electric Storage Battery Power Company, of Chicago. Alexander Ots, of San Francisco, becomes general manager of the California company, for which J. E. Haschke, Chicago, inventor of the car, will act as chief engineer. It is the intention of the Western corporation to erect its own factory where two types of 700-lb. runabouts, a light limousine and a commercial car for delivery purposes, will be built.

**Plan New Corporation to Operate Hamilton (Ohio) Gas & Electric Company.**—Plans are being made to organize a new corporation to take over the properties of the Hamilton Gas & Electric Company and the Hamilton Otto Coke Company, of Hamilton, Ohio, which have been in the hands of receivers for some time and were recently purchased by a committee acting for the bondholders. W. E. Hutton, of W. E. Hutton & Company, bankers, of New York, is chairman of the committee now in charge of the properties. A meeting of the bondholders will be called shortly by the committee, with a view to making plans for the organization of a new company.

**Southern Aluminum Company Awards Power-Plant Contracts.**—The Southern Aluminum Company, which, as noted in the *Electrical World*, June 22, 1912, was recently organized with the support of the Banque Franco-Americaine, of Paris, and the Bank Leu & Company, of Zurich, to manufacture aluminum near Whitney, N. C., has awarded contracts for the construction of a large power station on the Yadkin River, near Whitney, prior to the establishment of its aluminum works at that place. Contracts aggregating $600,000 have been let for the completion of a 4-mile canal and a dam. It is understood that the development of nearly 50,000 hp will be made ultimately by the company.

**American Gas & Electric Increases Ohio Holdings.**—The properties of the Lancaster (Ohio) Electric Light Company and those of the Mount Vernon (Ohio) Electric Company have been purchased by the American Gas & Electric Company. The latter already controls public-utility properties at Canton, Newark, Tiffin and Fremont, Ohio. Each of the newly acquired companies serves a population of about 15,000. The Mount Vernon station has been built but a short time. In addition to supplying energy for lighting and motor service the Mount Vernon company leases the local car line and also an interurban line operating near Mount Vernon.

**New York State Telephone Merger Opposed.**—The Public Service Commission for the Second New York District has denied an application to consolidate the independent telephone companies in northern New York State with the Bell company. The commission states that, while the general purposes of the consolidation meet with its approval, the evidence showed that an increase in rates was contemplated after consolidation and that the application is denied for that reason.

**Plan Hydroelectric Development in Utah.**—Plans of the Provo & Eastern Utah Railroad, which was recently incorporated with a capital of $10,000,000 for extensive railroad developments in Utah, include the building of a dam on the Green River at Split Mountain, northeast of Jensen, for supplying water for the irrigation of several hundred thousand acres of land, and the erection of a large hydroelectric station to furnish energy in eastern Utah.

**Chicago Sanitary District Equipment.**—The contract for furnishing and installing the electrical equipment of the Thirty-ninth Street substation of the Sanitary District of Chicago was awarded to the W. A. Jackson Company of that city for $12,500. This substation is a part of the new street-lighting equipment provided by the Sanitary District for the city of Chicago.

**British Columbia Electric Railway Company, Ltd., to Build.**—A contract for construction of a dam 115 ft. high by 765 ft. long on the Jordan River, about 40 miles from Victoria, B. C., has been awarded by the British Columbia Electric Railway Company, Ltd., of Vancouver, B. C., to the Ambursen Hydraulic Construction Company, of Boston.

**Electric Bond & Share Negotiating for Utah Properties.**—While no definite statement will be made by the Electric Bond & Share Company concerning reports that it is behind the negotiations now in progress for purchasing control of several public-utility properties in Utah, the presence of one of its officers, F. L. Dame, in that State strengthens the belief that the company is actively interested in the transactions. These are being made, it is understood, with a view to consolidating the Knight Power Company, the Davis & Weber Counties Canal Company, which operates several generating stations, the Salt Lake & Ogden Railway Company and the Merchants' Light & Power Company, of Ogden, as was mentioned in these columns July 27. All of the stock of the last-named company has been deposited under an agreement of sale to the Electric Bond & Share Company, according to an announcement by Simon Bamberger, the principal owner of the company. Stockholders of the Knight Power Company recently authorized sale of all of the company's holdings at $1.40 a share. The company has $1,200,000 in capital stock outstanding. It is stated that $50,000 was paid by Mr. Dame in July, and that the balance, $1,630,000, is to be paid on Oct. 15. As noted in these columns Aug. 3, the Telluride Power Company was sold recently, and while no statement will be made, it is understood that it was purchased in the interest of the Electric Bond & Share Company. Stockholders of the Davis & Weber Counties Canal Company held a meeting recently to vote upon selling their power properties but not their irrigation properties to the Electric Bond & Share Company.

**John D. Ryan on the World's Copper Market.**—New York newspapers quoted John D. Ryan this week as making the following comments upon copper-market conditions throughout the world, upon his return from Europe on Aug. 10. "Copper consumption," said Mr. Ryan, according to these accounts, "is outstripping production. The copper business is at its height abroad. I went through France, Germany, Austria, Italy and England and I found the uses of copper metal on the increase everywhere, with the demand growing proportionately. While the industrial condition in France, England and other countries is excellent, Germany is making the most tremendous strides and outstripping the world in manufactures of all kinds. These German products are being sent broadcast over the world. As I said, I would like to see a greater increase in copper stocks. I hope that the refinery showing from now on will be above 130,000,000 lb. a month. I found the crops in Europe to be in splendid shape with a most gratifying outlook in every direction." He added that the increase last month in copper stocks (shown in the July statement of the Copper Producers' Association, on page 379) was entirely inadequate, and that he would like to see a much larger accumulation of surplus copper.

**Middle West Utilities Company Seeking Kentucky Properties.**—Negotiations looking toward purchase by the Middle West Utilities Company, of Chicago, of controlling interest in the Shelbyville (Ky.) Water & Light Company are now in progress. Efforts are being made by the Chicago interests, through Bernard Flexner, an attorney of Louisville, to purchase stock of the Kentucky company now held by a syndicate in Shelbyville composed of the principal stockholders. The Shelbyville company was organized in 1894, with a capital stock of $26,000 and a bonded indebtedness of $50,000. It has a plant valued approximately at $80,000. The Chicago interests acquired control of the public utilities at Somerset and Versailles, Ky., within the past three months. The city of Midway, Ky., has been approached by the Middle West Utilities Company with a view toward purchase of the municipal electric-lighting plant operated in that place. An offer to light Midway at a cost of $1,000 per annum and to handle commercial business at rates authorized by the municipality, besides a reasonable purchase price, has been made, but the General Council has decided simply to take the matter under advisement and there is no prospect for immediate action.

**Western Electric's July Business Showed Gain.**—Business of the Western Electric Company for July was 3 per cent greater than that in July, 1911. For the seven months ended July 31, business was at the rate of more than $67,000,000 for the year, which was the estimate made for 1912 at the beginning of the year. In the lighting and general supply products, last month's business was the largest for July in the history of the company. Prices were somewhat higher, and the volume of orders was larger. Orders on hand at the first of August were approximately $1,500,000 greater than orders on hand the first of the year. While demand has been good from all over the country, the response has been slower from the West and Pacific Coast than in other portions. Foreign business of the country is good, and shows even a better increase than in the domestic field. Plans have been made for some new buildings to be erected at Hawthorne, Ill., which will cost approximately $750,000. These will take care of increases in the company's business in the future.

**Swiss Aluminum Industry.**—Consul-General Robert E. Mansfield, reporting from Zurich on Swiss commerce and industries, says that while the manufacture of aluminum is one of the comparatively new industries in Switzerland, it has made rapid progress in recent years. Aluminum kitchen utensils have practically replaced tin and enameled ware, and aluminum electrical apparatus and appliances, advertising novelties and souvenirs are manufactured extensively. There are nine aluminum factories in the Swiss confederation, the largest being the Schweizerische Aluminum Industrie A. G., of Neuhausen, the total output of which in 1910 was 8000 tons. There are other important factories at Olten, Basel and Binningen. Aluminum exported from Switzerland in 1911 was valued at $1,303,143, a gain of $52,389 over the total in the preceding year. Of this, $72,389 went to the United States.

**Orders Sale of Chicago & Milwaukee Electric Railroad.**—On Aug. 8 Judge Geiger entered an order in the federal court in Milwaukee directing the sale of the Chicago & Milwaukee Electric Railroad Company and the foreclosure of a $10,000,000 mortgage. The company, whose general office is at Highwood, Ill., has been in financial difficulties for some time and is in the hands of a receiver. It is said that after the sale the company will be reorganized. An interurban electric railway near the shore of Lake Michigan and connecting nearly all the cities between Chicago and Milwaukee is operated. Electrical energy is purchased from the Public Service Company of Northern Illinois.

**Cumberland County Power & Light Company (Maine) Sells Bonds.**—A $1,700,000 block of its first and refunding 5 per cent thirty-year bonds, dated Aug. 1, 1912, has been sold by the Cumberland County Power & Light Company, of Portland, Maine. The proceeds will be applied for payment for its 8000-kw station on the Saco River, about 25 miles from Portland, and for other extensions that have been made to the property. Details of the company's financial affairs and its properties appeared in these columns April 6, 1912. A. B. Leach & Company, of New York, were the purchasers of the bonds.

**New York State Companies Merged.**—The Public Service Commission for the Second New York District has authorized the Catskill Illuminating & Power Company, of Catskill, the Schoharie Light & Power Company and the Upper Hudson Electric Light & Railroad Company, of Newburgh, to consolidate. The new corporation is to be known as the Upper Hudson Electric & Railroad Company and will have an authorized capital of $150,000. The Schoharie company is authorized to purchase the property of the Cairo Electric & Power Company before the consolidation is accomplished.

**Automatic Telephone Company (Tex.) Plans Stock Increase.**—The Dallas (Tex.) Automatic Telephone Company has filed with the city commission a petition for approval of a charter amendment allowing it to increase its capital stock by $200,000. The funds will be used in paying for construction completed and planned, which exceeded estimates by nearly 50 per cent. The company will also issue $250,000 in bonds.

**Shawinigan (Que.) Water & Power Company to Increase Capital Stock.**—Shareholders of the Shawinigan Water & Power Company will be asked at a meeting called for Sept. 3 to authorize an issue of $5,000,000 additional capital. The authorized capital stock of the company is $20,000,000, of which $10,000,000 remains unissued.

**Otis Elevator Business Shows Increase.**—During the first six months of the present year business of the Otis Elevator Company increased about 7 per cent over that in the corresponding period in 1911. According to W. D. Baldwin, the president, a steady increase in demand continues all over the world. The largest increase at present is shown in Canada. European business and South American business are also on a growing scale. The company has recently completed additions to its plant in Germany in order to meet the increasing demand upon it. Earnings of the company have shown an increase every year for the past five years, with the exception of 1911, when a decrease of about 6 per cent in net earnings compared with those in 1910 took place. Dividends at the rate of 4 per cent on the common stock and 6 per cent on the preferred are now being paid by the company.

**Allis-Chalmers Earned Surplus of Over $20,000 in June.**—For the first time in many months the Allis-Chalmers Company earned a surplus in June over expenses and depreciation. After depreciation of about $34,000 there was left a surplus for the month of between $20,000 and $25,000. Some falling off took place in the early part of July, but toward the end of the month business picked up again, and thus far in the month of August further improvement has been made. The showing is regarded in financial circles as exceptionally creditable, in view of the fact that the company is still in the hands of a receiver. Owing to suits brought by stockholders and others to stay the foreclosure proceedings, it will be some time before the receivership is terminated.

**American Telephone & Telegraph President on "Big Business."**—Theodore N. Vail, president of the American Telephone & Telegraph Company, in an interview in the New York *World* of Aug. 11, says that no government can run business and that no business can run government; that business should have a pretty free hand but should be made and held responsible. He states that there are laws enough, but that there should be no doubt as to the meaning of a law. Uncertainty, he thinks, is what kills business. Mr. Vail is in favor of allowing corporations to capitalize their good-will, holding that this is earning capacity capitalized. He says that all public utilities can hope for is to be allowed to earn a fair return on their capital.

**New Western Union Building in New York.**—Plans have been filed in New York for a new twenty-eight-story building for the Western Union Telegraph Company, to be built upon the site of its present structure at the northwest corner of Broadway and Dey Street and extending through to Fulton Street. Twenty-one elevators will be installed in the new building.

## REPORTS OF EARNINGS.

BANGOR (ME.) RAILWAY & ELECTRIC COMPANY.

| | Gross. | Net. | Surplus Over Charges. |
|---|---|---|---|
| June, 1912 | $61,590 | $33,257 | $16,699 |
| June, 1911 | 49,580 | 24,243 | 11,771 |
| 12 months, June, 1912 | 655,622 | 360,451 | 178,985 |
| 12 months, June, 1911 | 574,980 | 304,680 | 158,163 |

BATON ROUGE (LA.) ELECTRIC COMPANY.

| | | | |
|---|---|---|---|
| June, 1912 | $12,420 | $4,002 | $2,268 |
| June, 1911 | 9,870 | 3,034 | 1,306 |
| 12 months, June, 1912 | 134,811 | 53,260 | 32,501 |
| 12 months, June, 1911 | 114,267 | 40,574 | 19,896 |

BLACKSTONE VALLEY (R. I.) GAS & ELECTRIC COMPANY.

| | | | |
|---|---|---|---|
| June, 1912 | $94,053 | $28,677 | $19,804 |
| June, 1911 | 85,282 | 22,393 | 13,900 |
| 12 months, June, 1912 | 1,162,689 | 345,787 | 240,248 |
| 12 months, June, 1911 | 1,088,882 | 293,285 | 191,650 |

CAPE BRETON (N. S.) ELECTRIC COMPANY, LTD.

| | | | |
|---|---|---|---|
| June, 1912 | $29,448 | $12,656 | $6,954 |
| June, 1911 | 27,427 | 11,888 | 6,244 |
| 12 months, June, 1912 | 346,438 | 154,993 | 87,063 |
| 12 months, June, 1911 | 330,596 | 154,389 | 86,549 |

CHATTANOOGA (TENN.) RAILWAY & LIGHT COMPANY.

| | | | |
|---|---|---|---|
| June, 1912 | $89,470 | $34,578 | $12,432 |
| June, 1911 | 77,910 | 32,616 | 12,186 |
| 6 months, June, 1912 | 498,558 | 203,044 | 73,664 |
| 6 months, June, 1911 | 445,955 | 188,932 | 71,336 |

COLUMBUS (GA.) ELECTRIC COMPANY.

| | | | |
|---|---|---|---|
| June, 1912 | $45,531 | $22,585 | $9,639 |
| June, 1911 | 39,554 | 19,424 | 10,147 |
| 12 months, June, 1912 | 516,440 | 252,773 | 105,987 |
| 12 months, June, 1911 | 465,594 | 244,337 | 119,121 |

COMMONWEALTH POWER RAILWAY & LIGHT COMPANY (MICH.).

| | | | |
|---|---|---|---|
| June, 1912 | $483,418 | $188,130 | $60,473 |
| June, 1911 | 432,614 | 178,013 | 69,881 |
| 6 months, June, 1912 | 2,976,329 | 1,240,703 | 524,943 |
| 6 months, June, 1911 | 2,629,084 | 1,124,896 | 505,336 |

DALLAS (TEX.) ELECTRIC CORPORATION.

| | | | |
|---|---|---|---|
| June, 1912 | $142,342 | $54,735 | $30,069 |
| June, 1911 | 122,110 | 29,918 | 8,861 |
| 12 months, June, 1912 | 1,709,020 | 603,602 | 343,750 |
| 12 months, June, 1911 | 1,551,790 | 506,891 | 256,905 |

EDISON ELECTRIC ILLUMINATING COMPANY OF BROCKTON (MASS.).

| | | | |
|---|---|---|---|
| June, 1912 | $29,014 | $10,780 | $8,840 |
| June, 1911 | 26,134 | 7,449 | 5,674 |
| 12 months, June, 1912 | 371,937 | 133,854 | 110,829 |
| 12 months, June, 1911 | 333,505 | 114,071 | 92,951 |

EL PASO (TEX.) ELECTRIC COMPANY.

| | | | |
|---|---|---|---|
| June, 1912 | $60,175 | $27,316 | $20,851 |
| June, 1911 | 52,470 | 19,186 | 12,510 |
| 12 months, June, 1912 | 730,169 | 321,780 | 239,655 |
| 12 months, June, 1911 | 665,454 | 261,141 | 180,994 |

GALVESTON-HOUSTON (TEX.) ELECTRIC COMPANY.

| | | | |
|---|---|---|---|
| June, 1912 | $171,085 | $76,592 | $42,732 |
| June, 1911 | 134,934 | 51,357 | 32,323 |
| 12 months, June, 1912 | 1,733,952 | 674,329 | 356,229 |
| 12 months, June, 1911 | 1,416,149 | 527,732 | 283,756 |

HOUGHTON COUNTY (MICH.) ELECTRIC LIGHT COMPANY.

| | | | |
|---|---|---|---|
| June, 1912 | $19,441 | $7,087 | $3,037 |
| June, 1911 | 20,066 | 9,615 | 5,528 |
| 12 months, June, 1912 | 298,296 | 145,634 | 93,136 |
| 12 months, June, 1911 | 281,504 | 142,754 | 91,264 |

KANSAS GAS & ELECTRIC COMPANY.

| | | | |
|---|---|---|---|
| July, 1912 | $56,929 | $18,934 | $6,193 |
| July, 1911 | 54,914 | 15,498 | 5,323 |
| 12 months, July, 1912 | 1,012,488 | 355,259 | 211,728 |
| 12 months, July, 1911 | 970,589 | 323,092 | 214,400 |

NORTHERN TEXAS ELECTRIC COMPANY.

| | | | |
|---|---|---|---|
| June, 1912 | $144,974 | $68,671 | $47,826 |
| June, 1911 | 136,061 | 63,299 | 42,542 |
| 12 months, June, 1912 | 1,643,215 | 749,186 | 497,420 |
| 12 months, June, 1911 | 1,540,192 | 689,710 | 463,379 |

PENSACOLA (FLA.) ELECTRIC COMPANY.

| | | | |
|---|---|---|---|
| June, 1912 | $23,946 | $9,939 | $3,562 |
| June, 1911 | 24,742 | 9,635 | 4,659 |
| 12 months, June, 1912 | 286,030 | 105,827 | 36,191 |
| 12 months, June, 1911 | 284,165 | 109,143 | 52,179 |

PORTLAND (ORE.) RAILWAY, LIGHT & POWER COMPANY.

| | | | |
|---|---|---|---|
| June, 1912 | $582,964 | $305,282 | $156,242 |
| June, 1911 | 554,767 | 292,595 | 163,440 |
| 6 months, June, 1912 | 3,252,617 | 1,605,280 | 734,104 |
| 6 months, June, 1911 | 3,114,812 | 1,610,676 | 867,852 |

ST. JOSEPH (MO.) RAILWAY, LIGHT, HEAT & POWER COMPANY.

| | | | |
|---|---|---|---|
| June, 1912 | $93,923 | $37,522 | $17,812 |
| June, 1911 | 95,021 | 37,915 | 19,462 |
| 6 months, June, 1912 | 567,156 | 239,863 | 121,856 |
| 6 months, June, 1911 | 530,322 | 208,321 | 92,847 |

SAVANNAH (GA.) ELECTRIC COMPANY.

| | | | |
|---|---|---|---|
| June, 1912 | $65,016 | $16,038 | $4 |
| June, 1911 | 59,928 | 15,317 | $11 |
| 12 months, June, 1912 | 729,425 | 189,063 | 1,035 |
| 12 months, June, 1911 | 662,047 | 183,935 | 1,184 |

SOUTHERN CALIFORNIA EDISON COMPANY.

| | | | |
|---|---|---|---|
| Year, May, 1912 | $4,011,068 | $2,009,527 | $676,077 |
| Year, May, 1911 | 3,473,455 | 1,706,942 | 438,699 |

TAMPA (FLA.) ELECTRIC COMPANY.

| | | | |
|---|---|---|---|
| June, 1912 | $61,874 | $29,983 | $25,619 |
| June, 1911 | 56,813 | 24,121 | 18,725 |
| 12 months, June, 1912 | 726,639 | 338,196 | 282,590 |
| 12 months, June, 1911 | 615,365 | 269,402 | 211,718 |

THE LOWELL (MASS.) ELECTRIC LIGHT CORPORATION.

| | | | |
|---|---|---|---|
| June, 1912 | $31,762 | $11,594 | $9,992 |
| June, 1911 | 29,217 | 10,301 | 8,797 |
| 12 months, June, 1912 | 398,854 | 141,140 | 122,648 |
| 12 months, June, 1911 | 442,061 | 153,749 | 134,994 |

UNION RAILWAY, GAS & ELECTRIC COMPANY (ILL.).

| | | | |
|---|---|---|---|
| June, 1912 | $272,714 | $110,562 | $41,260 |
| June, 1911 | 237,408 | 96,080 | 34,838 |
| 6 months, June, 1912 | 1,751,319 | 698,573 | 289,647 |
| 6 months, June, 1911 | 1,518,456 | 620,490 | 257,341 |

## JULY STATEMENT OF COPPER PRODUCERS' ASSOCIATION.

The July and June statements of the Copper Producers' Association compare as follows:

| | July, Pounds | | June, Pounds | |
|---|---|---|---|---|
| Stocks on hand in the United States on first of month | | 44,335,004 | | 49,615,643 |
| Production | | 137,161,129 | | 122,315,240 |
| | | 181,496,138 | | 171,930,883 |
| Domestic deliveries | 71,094,381 | | 66,146,229 | |
| Export deliveries | 60,121,331 | | 61,449,650 | |
| | | 131,215,712 | | 127,595,879 |
| | | 50,280,421 | | 44,335,004 |

## PRICES IN NEW YORK METAL MARKET.

| Copper: | Aug. 6 Bid. | Aug. 6 Asked. | Aug. 13 Bid. | Aug. 13 Asked. |
|---|---|---|---|---|
| Standard: | | | | |
| Spot | 17.00 | 17.50 | 17.25 | 17.50 |
| August | 17.00 | 17.50 | 17.25 | 17.50 |
| September | 17.20 | 17.50 | 17.25 | 17.50 |
| October | 17.20 | 17.50 | 17.25 | 17.50 |
| November | ..... | ..... | 17.20 | 17.50 |
| London quotation: | £ s d | | £ s d | |
| Standard copper, spot | 78 10 0 | | 78 12 6 | |
| Standard copper, futures | 78 15 0 | | 78 12 6 | |
| Prime Lake | 17.55 to 17.65 | | 17.60 to 17.70 | |
| Electrolytic | 17.55 to 17.65 | | 17.60 to 17.70 | |
| Casting | 17.30 to 17.35 | | 17.35 to 17.45 | |
| Copper wire, base | 19.00 | | 19.00 | |
| Lead | 4.50 | | 4.50 | |
| Sheet zinc, f.o.b. smelter | 8.75 | | 8.75 | |
| Spelter, spot | 7.05 | | 7.00 | |
| Nickel | 40.00 to 41.00 | | 40.00 to 41.00 | |
| Aluminum: | | | | |
| No. 1 pure ingot | 21½ to 22½ | | 21½ to 22½ | |
| Rods and wire, base | 32 | | 32 | |
| Sheets, base | 33½ | | 33½ | |
| OLD METALS. | | | | |
| Heavy copper and wire | 15.75 | | 15.75 | |
| Brass, heavy | 10.00 | | 10.00 | |
| Brass, light | 8.00 | | 8.00 | |
| Lead, heavy | 4.15 | | 4.15 | |
| Zinc, scrap | 5.75 | | 5.75 | |

## COPPER EXPORTS IN AUGUST.

| | Aug. 6 | Aug. 13 |
|---|---|---|
| Total tons, including | 3,606 | 7,788 |

## STOCK MARKET PRICES.

| | Aug. 7. | Aug. 14. |
|---|---|---|
| Allis-Chalmers | 1⅛* | 1½* |
| Allis-Chalmers, pf | 4¾* | 5⅜* |
| Amalgamated Copper | 83 | 85⅜ |
| Amer. Tel. & Tel. | 146 | 146⅛ |
| Boston Edison | 297½* | 291* |
| Commonwealth Edison | 139½ | 138½ |
| Electric Storage Battery | 56 | 57¼ |
| General Electric | 182 | 183¼ |
| Mackay Companies | 90¾ | 89 |
| Mackay Companies, pf | 69* | 69¼* |
| Philadelphia Electric | 23⅜ | 23½ |
| Western Union | 81½ | 83½ |
| Westinghouse | 84¾ | 88 |
| Westinghouse, pf | 125* | 126 |

*Last price quoted.

# Personal

**Mr. E. V. Howe,** formerly superintendent of the Arlington (Mass.) Gas Light Company, has recently become associated with the engineering staff of the Light, Heat & Power Corporation of Boston.

**Mr. Robert McA. Lloyd,** long associated with the electric-vehicle industry, has resigned as vice-president of the General Vehicle Company and is now with the International Motor Company as assistant to the president.

**Sir William Ramsay** has expressed his intention to visit America during September in connection with the International Congress of Applied Chemistry, which will convene at Washington and New York from Sept. 4 to 13.

**Mr. Richard A. Brooks,** formerly secretary of the Bristol (Tenn.) Gas & Electric Company, has been appointed manager of the Massillon (Ohio) Electric & Gas Company to succeed **Mr. R. E. Burger,** who will supervise the erection of a system for transmitting energy to Lorain and Elyria, Ohio.

**Mr. F. W. Rose,** formerly associated with the Arnold Company, Chicago, and later with Charles L. Pillsbury, Minneapolis and St. Paul, has opened an office in Minneapolis for the practice of consulting engineering in mechanical and electrical lines, with particular reference to power-plant design.

**Mr. L. L. Nunn,** who organized the pioneer Telluride Power Company and served as its general manager since its inception and as its president since 1910, will hereafter devote his time to the Beaver River Power Company, which supplies energy from a plant in Malad Valley to mines at Newhouse and Frisco, Utah.

**Mr. Charles W. Ford** has resigned as general superintendent of the Grand Junction (Col.) electric lighting and railway properties to accept a similar position in Louisiana. Mr. Ford was the founder and is a past-president of the Fifty Thousand Club and a director of the Chamber of Commerce of Grand Junction.

**Mr. M. S. Hart,** formerly general manager of the Consumers' Electric Light & Power Company, New Orleans, La., has been appointed assistant to Mr. John F. Gilchrist, of the Middle West Utilities Company, Chicago, to assume charge of the commercial development of the property. Mr. Hart's successor is Mr. L. P. Hathorn.

**Mr. S. M. L. McSpadden,** purchasing agent for the Grand Junction (Col.) Electric & Gas Manufacturing Company, has been appointed general superintendent of this company and general superintendent and traffic manager of the Grand Junction & Grand Valley Railway Company to succeed Mr. Charles W. Ford, resigned.

**Dr. Peter Cooper Hewitt,** inventor of mercury-vapor apparatus with which his name has long been associated, is receiving the heartfelt sympathy of his friends over the death on Aug. 14 of his mother, Mrs. Sarah Amelia Hewitt, widow of the Hon. Abram S. Hewitt, Mayor of New York in 1887 and 1888, and daughter of Mr. Peter Cooper, the philanthropist.

**Mr. George L. Oill,** who has been manager of the heat, light and motor-service department of the city of St. Thomas, Ontario, has resigned from that position after a three months' leave of absence on account of failing health. Mr. Oill had charge of the municipally owned gas plant and electric-light plant, which now receives energy from the system of the Hydro-Electric Power Commission of Ontario, and made a success of both departments.

**Mr. George M. Miller** has been appointed superintendent of the distributing department of the Kentucky Electric Company, Louisville, Ky. In this position Mr. Miller succeeds **Mr. William Holloway,** whose assistant he has been for the past four years. Mr. Holloway has been compelled to resign because of ill health and will go to Chicago. Mr. Miller assumed his position with the Kentucky Electric Company upon his graduation from Purdue University.

# Obituary

**Mr. James Dynan Newton,** dean of the College of Engineering of Loyola University, Chicago, died on Aug. 8, aged forty. He was born in Oswego, N. Y., and was educated at Holy Cross College and Cornell University. For a number of years he was an engineering officer in the United States revenue cutter service. In 1896 he became assistant professor of civil engineering in the University of Kansas, his connection with Loyola University dating about a year back. He leaves a wife and two daughters.

**Mr. Joseph Le Conte Davis,** who died in Pittsburgh, Pa., on Aug. 5, was graduated from the University of South Carolina in 1897 with the degree of electrical engineer. From 1897 until 1900 he was professor of physics at the Bingham Academy High School in North Carolina. From 1900 to 1904 he was engaged in engineering work for the General Electric Company, Schenectady, N. Y. From 1904 until his death he was employed as designing engineer in the electric railway department of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., having been engaged on the design of the direct-current motor used on the Pennsylvania Railroad locomotives at New York and many other important installations.

# Construction

ATTALLA, ALA.—Press reports state that the Alabama Pwr. Development Co., of Talladega, will extend its transmission lines into Attalla at an early date. A transmission line to Anniston is being completed, and the erection of an auxiliary plant at Gadsden, as previouly reported, is contemplated.

COLLINSVILLE, ALA.—A fire at this city completely destroyed the power plant recently installed by Irby Hall, his loss being estimated at several thousand dollars. It is Mr. Hall's intention to rebuild the power house and install a duplicate equipment at once.

HALEYVILLE, ALA.—It is reported that the town commissioners have contracted with the J. B. McCrary Co., of Atlanta, Ga., to begin work at once on the water-works and electric-light system.

NEWPORT, ARK.—The City Council has granted a twenty-year franchise in Newport to J. H. Hamil, of De Soto, Mo., in return for which he has agreed to light the city with 80 tungsten lamps of 60 cp rating free of cost.

TUCKERMAN, ARK.—It is reported that the city has engaged Richard C. Huston, 630 Exchange Building, Memphis, Tenn., to prepare plans for water-works and an electric-light plant.

COLTON, CAL.—A franchise to construct an electric railway through Colton has been granted to the Pacific El. Ry. Co., of Los Angeles. The line will pass through Colton and thence northward to Urbita Springs, connecting with the company's line at that place.

DOWNIEVILLE, CAL.—The Downieville El. Co. is doubling the present capacity of its plant in order to be able to furnish continuous service.

GRAND JUNCTION, CAL.—A resolution has been passed by the City Council recommending that the services of an engineer be secured to investigate the desirability of installing a municipal electric light and power plant.

GRIMES, CAL.—It having been decided to install a lighting district in Grimes, plans are being matured for awarding the contract at an early date.

HALFMOON BAY, CAL.—It is reported that the Halfmoon Bay Lt. & Pwr. Co. expects to extend its transmission lines to Miramar, Princeton, Granada, Rivera, Marine View, Moss Beach, Montara and Farallone City. To cover the proposed extensions the company has applied to the State Railroad Commission for permission to increase its capital stock from $25,000 to $100,000, it being estimated that about $65,000 will be required for the work.

MORGAN HILL, CAL.—Application has been made to the Railroad Commission by the Sierra & San Francisco Pwr. Co., of San Francisco, for permission to operate in the cities of Morgan Hill and Gilroy and in San Benito County.

NORDHOFF, CAL.—It is reported that a power plant is soon to be installed in Nordhoff which will supply electrical energy to that city and neighboring towns, a company with a capital stock of $50,000, to be known as the Ojai Pwr. Co., having been practically arranged for. J. J. Burke and E. L. Wiest are interested in the project.

OROVILLE, CAL.—An electrically operated tramway is to be constructed by the Oro El. Corp. between the site selected for its $10,000,000 power plant in Humbug Valley and the place where the dam is to be built.

REDWOOD CITY, CAL.—Permission has been granted by the Board of Trade to the Fresno-Coalinga Railroad to construct an electric railway through Redwood City. It is reported that the company plans to extend its lines from Fresno to San Francisco, rights-of-way having been secured in Monterey and San Clara Counties.

RICHMOND, CAL.—It is reported that construction work is soon to be commenced on an electric railway at Richmond, Cal., which is to connect with the Southern Pacific Co.'s electric suburban service. H. C. Cutting, of Richmond, is interested in the proposition, and the necessary capital to carry on the work is said to have been secured.

SAN FRANCISCO, CAL.—It is reported that a contract has been entered into between the Union Iron Works Co. and the Pacific Gas & El. Co. which will result in the abandonment of the shipbuilding concern's present power plant and the substitution of electrical energy purchased from the Pacific company. Energy is to be delivered at 11,000 volts, and plans have been approved by the Union Iron Works for the erection of a new transformer station which will cost fully equipped in the neighborhood of $100,000.

STOCKTON, CAL.—It is reported that the Western States Gas & El. Co., of Richmond, Cal., which took over the plants of the Stockton Gas & El. Co. and the American River El. Co. at Stockton is planning to expend $50,000 in the improvement of its service. The plants of the above-mentioned companies are to be retained for the present, but ultimately the Western States Co. expects to have but one large generating plant.

TULARE, CAL.—Press reports state that the Tulare Lake Canal Co. may decide to employ electrical energy for operating the additional pumping station which it expects to install on Tulare Lake.

VALLEJO, CAL.—Condemnation proceedings have been instituted at Napa by the Great Western Pwr. Co., of San Francisco, to secure the right-of-way for its transmission line through Wild Horse Valley. The land is owned by the city of Vallejo.

YOLO, CAL.—Press reports state that the Yolo Wtr. & Pwr. Co. has under consideration the construction of a hydroelectric plant on Coche Creek in Lake County.

NEW HAVEN, CONN.—It is understood that plans are being drawn by Howes & Morse, 340 Madison Avenue, New York, for a new electrical laboratory for the Sheffield Scientific School. The structure will cost about $75,000, and estimates will probably be called for this fall.

HASTINGS, FLA.—It is reported that the Hastings Cold Storage Co., F. E. Bugbee, president, expects to install a $10,000 electric-light plant in this city.

AMERICUS, GA.—The Americus Pwr. Co., being unable to come to a satisfactory arrangement with the present lighting company, will at once commence construction of a power plant in this city.

AUGUSTA, GA.—It is the intention of the Augusta-Aiken Ry. & El. Co. to materially improve its old power plants. New switchboards are to be installed and the equipment made up to date.

EATONTON, GA.—The City Council has selected Solomon & Norcross to prepare plans for an electric-light plant, the necessary bonds for which are to be voted on. It is probable that the water plant will be modified so as to be operated by electricity.

MILLTOWN, GA.—At a recent election in this city it was voted to issue bonds to the amount of $5,000 for an electric lighting system.

VALDOSTA, GA.—The Valdosta Ltg. Co., successor to the Consol. Ice & Pwr. Co., expects to rebuild its transmission system and install much new equipment. W. D. Eager is general manager.

BLISS, IDAHO.—Among the extensions planned by the Beaver River Pwr. Co., of Bliss, is the construction of a transmission line from Boise to Caldwell.

BEECHER, ILL.—A proposition to issue $2,500 of bonds for the purpose of installing a municipal lighting plant is being considered by the citizens of Beecher.

KINGSTON, ILL.—A franchise to operate an electric-lighting system in Kingston has been granted to the Illinois Northern Utility Co. by the Village Board.

RANKIN, ILL.—An application for permission to install an electric-lighting system in Rankin has been filed with the Village Board by H. L. Clark and Edwin Johnson, of Paxton, it being their intention to construct a transmission line from the latter city to Rankin.

ROCK ISLAND, ILL.—Bids will be received until Aug. 19 by Oscar Wenderoth, supervising architect, Treasury Department, Washington, D. C., for installing complete an electric passenger elevator and an electric freight elevator in the United States Post Office at Rock Island, Ill.

AURORA, IND.—Press reports state that the plant of the Aurora Gas Lt. & Coal Co. has been acquired by the Indiana Public Service Co., of Aurora. It is the intention of the new owners to repair and operate the plant.

CUTLER, IND.—The Wildcat El. Co. is reported to have been organized to construct a power house at the Adams Mill dam. Bids will be asked for the construction and equipment of the plant as soon as franchises are secured.

ELKHART, IND.—It is the intention of the Indiana & Michigan El. Co., which is constructing a dam and power house at this city, to erect transmission lines throughout the St. Joseph Valley.

KENDALLVILLE, IND.—It is reported that the McCray Refrigerator Co. is constructing a power plant which will cost approximately $50,000, the electrical energy from which is to be used in the operation of its machinery.

NEW ALBANY, IND.—The United Gas & El. Co. is extending its transmission lines from New Albany to Jeffersonville.

NOBLESVILLE, IND.—The Noblesville Ht., Lt. & Pwr. Co. has under way and in contemplation improvements in its system which will represent an expenditure of about $14,000.

PRINCETON, IND.—The Evansville Public Service Co., which recently absorbed the Evansville & Southern Indiana Trac. Co., is planning to install a substation at Princeton. It also has under consideration the matter of constructing an electric line from Patoka to Sullivan.

RUSHVILLE, IND.—Bids will be received by the County Commissioners until Aug. 28 (readvertisement) for constructing a power and heating plant in the court house and jail. Jesse Stoner, county auditor.

BOONE, IA.—It is reported that the Boone El. Co. contemplates the construction of a transmission line from Boone to Madrid, the necessary right-of-way having been applied for.

BURT, IA.—In the issue of Aug 10 it should have been stated that the Municipal El. Lt. Plant of Algona is considering the erection of a transmission line to Burt, in order to furnish a lighting service in that city. It is estimated that an expenditure of about $12,000 would be required by the citizens of Burt should such a service be decided upon.

CENTRAL CITY, IA.—The Wapsipinicon Pwr. Co., of this city, has been granted permission to construct transmission lines along the public highways to Mechanicsville, Stanwood, Clarence and Tipton, and it is probable that construction work will be commenced at once.

CRESTON, IA.—Owing to a confusion of names an item was published in our columns to the effect that the Creston Mutual El. Lt., Ht. & Pwr. Co. had been sold to a syndicate. The company which passed into the hands of the syndicate in question was the Creston Gas & El. Co., as announced in our issue of July 27.

HARTLEY, IA.—To take care of the increased demand for service, the owners of the Municipal El. Lt. plant are making arrangements to double the capacity of the present system.

HASTINGS, IA.—The Glenwood El. Lt. & Pwr. Co. expects to install an electric-lighting system in this city, a franchise for the purpose having been applied for.

NEWTON, KAN.—It is reported that the contract for the Kansas Gas & El. Co.'s new power house has been awarded to John Fleming, of Wichita, the price being $25,000.

NORTON, KAN.—R. W. Hemphill, city clerk, writes that bonds to the amount of $20,000 have been sold, the proceeds to be used for an electric-light plant. N. L. Johnson is Mayor.

HODGENVILLE, KY.—It is reported that an electric-light plant is to be installed in this city by Emmett Smith, of Chicago, Ill.

WHITESBURG, KY.—The Whitesburg Tele. Co. contemplates the extension of its local and long-distance telephone lines from Whitesburg to McRoberts. Connections are also to be established with Jenkins and its suburbs.

DONALDSONVILLE, LA.—Plans are being considered by Mayor Maurin and a number of representative business men looking toward the installation of a municipal lighting plant. A committee has been appointed to consult the city attorney as to the authority of the Council to vest in a commission of five the power to borrow $40,000 to install such a system.

JAY, MAINE.—The H. P. Cummings Const. Co., of Ware, Mass., has secured a contract from the International Paper Co., at Cadysville, N. Y., for the construction of a hydroelectric plant at Jay, to develop about 3000 hp.

WATERVILLE, MAINE.—Work has been commenced by the Central Maine Pwr. Co., of this city, on a high-tension transmission line between Belfast and Farmingdale.

CENTERVILLE, MD.—On account of alleged dissatisfaction with the present service, the Town Commissioners have filed an application for the issuance of a certificate from the Public Service Commission of Maryland authorizing them to erect a lighting plant at Centerville.

CUMBERLAND, MD.—It is reported that work on a new power house for the Ann and Hope Mill of the Lonsdale Co. has been commenced. Machinery is to be installed for the purpose of supplying light to the mill. The contractors are Williams & Williams, of Providence.

AMESBURY, MASS.—Permission has been granted by the State Board of Gas and Electric Light Commissioners to the Amesbury El. Lt. Co. to issue the necessary amount of stock to finance its proposed extensions.

BOSTON, MASS.—The Gas and Electric Light Commissioners have approved the proposed consolidation of the Hyde Park El. Lt. Co. with the Edison El. Ill. Co. of Boston. Permission to issue 26,007 shares of new stock at $215 per share has also been granted, a portion of which is to be used for proposed additions to the company's plant.

ENFIELD, MASS.—A proposition to install an electric-lighting system in Enfield has been made to the City Council by the Central Massachusetts El. Co., of Palmer, Mass.

GLOUCESTER, MASS.—A 600-ft. cable is being laid across the Narrows by the Gloucester El. Co.

GREENFIELD, MASS.—The Massachusetts Northern Rys. Co. expects soon to commence the construction of an electric railway from Orange to Millers Falls, the necessary franchises having been secured. J. A. Taggart is general superintendent.

HADLEY, MASS.—A franchise to furnish electrical energy for lamps and motors throughout the city of Hadley has been granted to the Amherst Gas Co., a subsidiary company of the Turners Falls Co.

HAMPDEN, MASS.—The Central Massachusetts El. Co., of Palmer, Mass., has under consideration the establishment of an electric-lighting system in Hampden.

LENOX, MASS.—It is reported that the Lenox El. Co. contemplates the erection of a new switch house in this city.

NORTH EASTON, MASS.—The Edison El. Illg. Co., of Brockton, has been granted a contract to light the city of North Easton, and the work of substituting electricity for gasoline will be commenced at once.

SPRINGFIELD, MASS.—It is reported that the proposed plan for lighting Court Square, in this city, has been approved by the Park Board. The plan comprises the placing of 31 poles, each bearing a group of five tungsten lamps, in Elm and West Court Streets around the square.

GRAND RAPIDS, MICH.—Press reports state that the Roseberry-Henry El. Co. has been awarded the contract for engines, generators, switchboards and wiring for the factory of the C. P. Limbert Co., Holland, Mich.

CHISHOLM, MINN.—It is reported that the citizens of Chisholm are considering the advisability of taking over the Range Pwr. Co.'s electric light and power system and that a special election is to be called to vote on the question.

MARSHALL, MINN.—It is reported that an ornamental street-lighting system is soon to be installed in Marshall, $1,200 having already been subscribed by the business men of the city for this purpose.

ROCHESTER, MINN.—It is reported that the City Council has voted to extend the ornamental street-lighting system in Rochester.

ST. CLOUD, MINN.—The matter of installing a "white way" is under consideration by the citizens of St. Cloud.

CARTHAGE, MO.—Press reports state that the Empire Fixture Works of this city is planning to install considerable electrical equipment in its new plant.

LEWISTON, MONT.—The Butte El. & Pwr. Co., which is building a high-tension transmission line from Great Falls to Lewiston, expects soon to commence work on the rebuilding of its local distribution system.

MISSOULA, MONT.—It is stated that the Mountain States Tele. Co. contemplates the expenditure of about $100,000 in the extension of its toll lines.

NEMAHA CITY, NEB.—It is understood that negotiations are under way between the Stella Lt., Ht. & Pwr. Co., of Stella, and the citizens of Nemaha City looking toward the installation of an electric-lighting system in the latter place.

RISING CITY, NEB.—Bids will be received by R. P. Showalter, village clerk, for a 50-hp electric oil engine, a 22½-kw, 125 to 250-volt, three-wire generator, a 20-amp storage battery, pole-line material and construction, a deep-well pump head complete, and for remodeling and enlarging the pumping plant. Alamo Engine & Supply Co., of Omaha, is the engineer.

MASON, NEV.—The substation of the Truckee River Gen. El. Co., of Reno, Nev., at the Bluestone Mine in Mason was entirely destroyed by fire. It is the intention of the company to rebuild the plant at once.

MINDEN, NEV.—Work has been commenced in this city on a power plant intended for the Douglass Milling & Pwr. Co. A transmission line is also to be erected between Sarman and Gardnerville.

EAST TILTON, N. H.—The Laconia Gas & El. Co., of Laconia, is making many improvements in its system at East Tilton.

FITZWILLIAM, N. H.—The New Hampshire Wtr. & El. Pwr. Co. has a transformer station under construction at Fitzwilliam, from which point it plans to construct transmission lines to Winchendon and Richmond at an early date.

JAFFREY, N. H.—It is reported that a deal has been consummated whereby the property of the Jaffrey & Troy El. Lt. Co. has been acquired by the New Hampshire Wtr. & El. Pwr. Co., of Portland, Me. An up-to-date lighting system is to be installed by the new owners.

MILFORD, N. H.—It is reported that the Milford Lt. & Pwr. Co. has commenced extensive improvements on its plant which will represent an expenditure of approximately $10,000. Three turbine waterwheels are to be installed in the main canal.

LIVINGSTON, N. J.—It is reported that the installation of an independent electric-lighting system for the almshouse in Livingston is being considered.

NEWARK, N. J.—A contract with the Public Service El. Co. for lighting the Plank Road between Blanchard Street, Newark, and Marcy Avenue, Jersey City, has been authorized by the Board of Freeholders. The aggregate amount of the contract on the basis of one year is $6,265. It is proposed to install fifty 2000-cp arc lamps, one for each 200 linear feet of road. The bridge approaches and draws will require 132 32-cp incandescent lamps.

PHILLIPSBURG, N. J.—The advisability of installing a municipal lighting plant is being considered by the citizens of Phillipsburg.

SOUTH ORANGE, N. J.—Bids will be received until Aug. 19 by the Village Board of Trustees for a generating set consisting of one 8-kw compound-wound, 250-volt, 575-r.p.m. direct-current generator, mounted on common bedplate and coupled to a vertical single-cylinder 13-hp, 575-r.p.m., 125-lb. steam-pressure engine, one slate switchboard with the following mountings: one 50-amp circuit-breaker, two ground detector lamps, two 5-cp, 220-volt lamps, one rheostat, one 60-amp, two-point single-throw switch, three 30-amp, two-point single-throw switches, six inclosed fuses, one 50-amp ammeter and one 300-volt meter.

BUFFALO, N. Y.—Press reports state that Lupfer & Remick, Ellicott Square Building, Buffalo, have been awarded a contract for the construction and equipment of hydroelectric plants at Oswego, Fulton and Phoenix, for the operation of the Oswego branch of the State Barge Canal.

CASTLETON, S. I., N. Y.—Bids will be received by the Department of Public Charities, New York City, Michael J. Drummond commissioner, until Aug. 19 for furnishing materials for erecting and completing an independent generating plant for the Sea View Hospital, Manor Road, borough of Richmond, city of New York; security $25,000. Also, same time and place, for furnishing materials, erecting and completing an additional boiler and accessories for the above hospital; security $7,500. Raymond F. Almirall, architect, 185 Madison Avenue, New York.

CATSKILL, N. Y.—The Public Service Commission at Albany has authorized the Catskill Illg. & Pwr. Co., the Middleburgh & Schoharie El. Lt., Ht. & Pwr. Co. and the Upper Hudson El. Co. to consolidate and form a new corporation to be known as the Upper Hudson El. & R. R. Co. Before the consolidation is accomplished the Schoharie company is authorized to purchase the property of the Cairo El. & Pwr. Co. The new capital allowed provides for $34,000 cash for new improvements, which include the building of a new substation at Tannersville, a new street-lighting system for Catskill and improvements to the steam plant, including two new boilers.

DRESDEN, N. Y.—It is reported that the Yates Electric Lt. & Pwr. Co., of Penn Yan, is planning to install a lighting system in Dresden.

GARBUTT, N. Y.—It is reported that the Lycoming Calcining Co. of this city has abandoned its power plant, and that it will enter into a contract with the Livingston-Niagara Pwr. Co., of Avon, N. Y., for the necessary electrical energy to operate its mines and mills.

GREENE, N. Y.—The contract for the electric and telephone wiring in the proposed new hotel to be erected by the Chenango Hotel Co., Fred S. Martin, secretary, bids for which were opened July 15, has been awarded to L. G. Martin, of Greene. Contracts are yet to be let for electric fixtures, telephones, vacuum cleaners, etc.

HORSEHEADS, N. Y.—The village of Horseheads has closed a contract with the Elmira Wtr., Lt. & R. R. Co. to furnish electrical energy for the operation of its pumping plant. Electric motors are to replace the gasoline engines formerly used.

LOCKPORT, N. Y.—After considerable controversy, the Lockport Lt., Ht. & Pwr. Co. has been instructed by the Common Council to install a modern street-lighting system on Main Street.

NEWBURGH, N. Y.—An appropriation of $600 for an ornamental street-lighting system on Second Street in this city has been approved by the Council.

NEW YORK, N. Y.—Bids will be received until Sept. 10 by the Public Service Commission for the First District, New York City, for constructing Section 1 of the Lexington Avenue subway.

OXFORD, N. Y.—The Oxford El. Lt. Co. contemplates the construction of transmission lines between Norwich and Oxford and between Oxford and Guilford. It is estimated that about $14,000 will be required for the proposed extensions.

POTSDAM, N. Y.—The Public Service Commission, Second District, has authorized the Northern Pwr. Co. to exercise franchises granted by the towns of Oswegatchie and Lisbon for the furnishing to them of electrical energy. In the town of Lisbon a contract has been made with the Town Board for street lights in the lighting district.

SYRACUSE, N. Y.—Bids will be received until Aug. 24 by W. W. Cheney, president board of managers Syracuse Institute for Feeble-Minded Children, for installing an electric-light plant in that institution. H. W. Hoefer, state architect, Capitol, Albany.

WOLCOTT, N. Y.—Permission has been granted to the Northern Wayne El. Lt. & Pwr. Co., of this city, by the Public Service Commission, Second District, to exercise franchises for the furnishing of electrical energy in Fairhaven, Sterling and Sodus. The company is also planning to construct transmission lines from Wallington to Sodus Center, from Alton to Sodus Point and from Red Creek to Fairhaven.

HICKORY, N. C.—In the issue of July 27 it was incorrectly stated that the Thornton Lt. & Pwr. Co. has increased its capital stock to $25,000, the correct amount being $125,000.

SCOTLAND NECK, N. C.—We are advised by the Municipal El. Lt. & Pwr. Plant, L. R. Hills, Jr., superintendent, that it is replacing the 34 arc street lamps with 50 series tungsten lamps, 30 of which will be 250-watt and 20 125-watt. It is also changing its system from direct to alternating current, 2300 volts primary, 110 volts secondary, 60 cycles, and installing a 90-kw generator.

VALLEY CITY, N. D.—Bids will be received until Aug. 20 by the City Council at the offices of M. J. Boyd, city auditor, for the new machinery for the municipal lighting plant, according to plans and specifications now on file at the office of the city auditor, copies of which will be sent upon request. Each bid must be accompanied by a certified check for at least 5 per cent of the amount of the bid, payable to W. T. Creswell, city treasurer.

BELLEVUE, OHIO.—A $25,000 bond issue is being considered by the Village Council, the proceeds to be used for a municipal lighting plant.

MARYSVILLE, OHIO.—The Marysville Lt. & Wtr. Co. writes that it is planning to substitute for its engines and generators a steam-turbine equipment. The steam engines in the ice plant and water-works will be replaced by motors. The Edison three-wire system in the central district will be supplied with energy from a motor-generator set, and the outlying districts will be fed from a 2300-volt, 60-cycle, three-phase distribution system.

MASSILLON, OHIO.—It has been recommended that the offer of the Massillon El. & Gas Co. for the installation of an improved lighting system be accepted, and details of the proposed changes are to be taken up at once.

PAULDING, OHIO.—Citizens of Paulding recently voted in favor of a $30,000 bond issue, the proceeds to be used in improving the electric-light plant and water-works. J. C. Armstrong is Mayor.

RAYLAND, OHIO.—The power house of the Portland Coal Co. at this city has been destroyed by fire. The owners are planning to rebuild the plant at once.

WILMINGTON, OHIO.—Frank Babb, village clerk, writes that the contract for lighting the streets (bids opened Aug. 9) has been awarded to the Wilmington Wtr. & Lt. Co., of Wilmington.

HERMISTON, ORE.—It is reported that J. A. Ralph, of Spokane, who recently disposed of his electric light and power company in Dayton, Wash., has purchased the interest of Leo Shupe in the Hermiston Lt. & Pwr. Co. The system is to be thoroughly overhauled and additional transmission lines erected.

SALEM, ORE.—Press reports from this city state that the application filed by D. P. Donovan, of Payette, Idaho, for permission to develop 15,000 hp from the Clackamas River, near its mouth, has been approved by State Engineer Lewis. By constructing a canal and flume 5½ miles long, obtaining a head of 109 ft., Mr. Donovan expects to develop 15,000 hp, which is to be used for power and municipal purposes. The estimated cost of the project is $1,250,000.

ALTOONA, PA.—It is the intention of the Penn Central Lt. & Pwr. Co. to erect a number of new transmission lines in Cambria County, the necessary permission for such extensions having been secured.

BENTLEYVILLE, PA.—The West Penn El. Co., of Pittsburgh, has been granted a franchise in Bentleyville, and work on the construction of a transmission line to that city is to be commenced at once.

BRADFORD, PA.—A committee has been appointed by the City Council to investigate the cost of installing a municipal lighting plant.

EASTON, PA.—On account of dissatisfaction over existing rates, plans are being considered by the citizens of Easton for the installation of a municipal lighting plant.

EASTON, PA.—An ordinance has been passed by the City Council requiring all electric light, power, telephone and telegraph wires to be placed in conduits within the fire limits of the city.

PERRYOPOLIS, PA.—The West Penn El. Co., of Pittsburgh, has taken over from the Washington Coal & Coke Co. the electric light and power business in Perryopolis. As the West Penn company's charter covers the entire township of Perry, it is proposed to extend the service to neighboring towns.

PHILADELPHIA, PA.—John R. Wiggins & Co. have obtained a permit for a one-story and basement electric power plant for the Philadelphia El. Co., the contract price being $60,000.

PHILADELPHIA, PA.—The Board of Education is reported to have awarded the contracts for the electric equipment of the West Philadelphia high school as follows: Horn & Brennan, gas and electric light fixtures, $25,414, and Diehl Mfg. Co., electric motors and connections, $7,500.

READING, PA.—It is reported that the Metropolitan El. Co. has entered into a contract to supply the Hotel Penn with electrical energy for lamps and motors for a period of ten years. The equipment consists of about 1000 16-cp lamps and 20 hp in motors. An electric passenger elevator is also to be installed. The old power plant of the hotel is to be abandoned.

PAWTUCKET, R. I.—It is the intention of the Hope Webbing Co. to include a 1000-hp power plant in the factory which it is erecting in Pawtucket.

PROVIDENCE, R. I.—It is reported that the Common Council, by a vote of 35 to 3, adopted the proposed lighting franchise agreement and contract with the Narragansett El. Ltg. Co. giving the company the exclusive rights in the city of Providence. The franchise involves a ten-year contract for street lighting and a five-year franchise for lighting, heating and power supply.

SPARTANBURG, S. C.—The Appalachian Pwr. Co., Spartanburg, is reported to have purchased lands and water-power rights near Henderson, N. C., to include the Narrows and Potts Shoals on the French Broad River, where 50,000 hp will be developed for transmission to other points. Ladshaw & Ladshaw, of Spartanburg, are the engineers in charge, and H. L. White, Horace Bomar and John A. Law, also of Spartanburg, are among those financially interested.

SPRINGFIELD, S. D.—Application for a franchise to install and operate an electric-lighting system in this city has been made by John Absher, of Wagner.

CHATTANOOGA, TENN.—It is reported that many improvements and extensions are planned for the plant of the Chattanooga Ry. & Lt. Co.

CHATTANOOGA, TENN.—It is reported that the Richmond Hosiery Mills, of East Chattanooga, Tenn., is arranging to substitute electrical energy for steam in the operation of its mills.

NASHVILLE, TENN.—The Nashville Ry. & Lt. Co. contemplates the extension of its electric line to Shelby Park and the Hyde Ferry Bridge.

BRYAN, TEX.—The Bryan & College Interurban Ry. Co. contemplates the construction of an electric line into the suburbs of Bryan.

COLLEGE STATION, TEX.—The contract for wiring the new main building of the Agricultural and Mechanical College at College Station has been awarded to the Borden El. Co., of Bryan, Tex., for $1,550.

FLORESVILLE, TEX.—A proposition to furnish electrical energy for operating the city water-works plant has been submitted to the City Council by C. F. Spencer and associates, who recently secured a franchise to install an electric-light plant at Floresville.

MURRAY, UTAH.—The citizens are reported to have voted to issue $60,000 bonds for the construction of a municipal electric-light plant at the mouth of the Big Cottonwood River.

BARRE, VT.—In order that their plants may be operated during the summer months when the water is low, plans are being considered by the granite manufacturers of this city looking toward the erection of a new power plant.

PITTSFORD, VT.—A new concern to be known as the Pittsford El. Lt. & Pwr. Co. has been organized under the laws of Massachusetts, and John P. Hanley, of Lawrence, Mass., is endeavoring to interest Rutland capitalists in the enterprise. The company is capitalized at $30,000, and plans to install a lighting system in Pittsford. Negotiations are under way with the Vermont Marble Co. for the old casket factory water-power at Pittsford Mills.

NATIONAL SOLDIERS' HOME, VA.—Bids will be received until Sept. 5 at the office of F. E. Skinner, treasurer Southern branch N.H.D. V. S., for furnishing and erecting two 250-hp steam boilers, power house building No. 15.

KALAMA, WASH.—It is reported that the Toutle Rural Tele. Co. has been granted a franchise to construct and operate a telephone line along certain roads in Cowlitz County.

KELSO, WASH.—It is the intention of the Washington-Oregon Corpn., of Vancouver, to extend its transmission line from Kelso to Chehalis and Centralia, a distance of 40 miles.

POTLATCH, WASH.—The Mason County Pwr. Co. is reported incorporated with a capital of $20,000 to build a power plant at Potlatch to supply electrical energy to the various parts of the county. Frank McKean is said to be interested.

SEATTLE, WASH.—A power plant is included in the buildings for the tuberculosis hospital at Richmond Springs, to be erected by the King County Anti-Tuberculosis League. The City Council has appropriated $100,000. R. H. Ober, superintendent of public buildings, will have charge of construction.

WINLOCK, WASH.—The electric-light plants of the J. A. Veness Lumber Co. and the O'Connell Lumber Co. have been purchased by the Washington-Oregon Corpn., of Vancouver. The O'Connell plant is to be rebuilt.

CHIPPEWA FALLS, WIS.—It is reported that the Chippewa Valley Ry., Lt. & Pwr. Co., of Eau Claire, has acquired the water-powers and property of the Chippewa Lumber & Boom Co. in Chippewa Falls, the consideration being $300,000. It is understood that a new dam is to be constructed by the present owners.

BROCKVILLE, ONT., CAN.—It is reported that at a special meeting in this city the Town Council authorized the Mayor to sign a contract with the Ontario Hydro-Electric Commission for the transmission of electrical energy to Brockville.

WELLAND, ONT., CAN.—The by-law providing for the purchase of hydroelectric energy from the Hydro-Electric Power Commission of Ontario was carried in Welland, Ont., by a vote of 328 to 183. An expenditure of $45,000 has been authorized.

MONTREAL, QUE., CAN.—The stockholders of the Canadian Lt. & Pwr. Co., of Montreal, have approved a resolution to increase the capital stock from $6,000,000 to $7,000,000, a portion of the increase to be used for construction work. The company operates a 20,000-hp hydroelectric plant on the St. Lawrence, and it is stated that plans for an ultimate development of 100,000 hp have been matured.

## New Industrial Companies

THE DILLON ELECTRIC COMPANY, of Canton, Ohio, has been incorporated with a capital stock of $10,000. The incorporators are Charles A. Dillon, Charles A. Kuehn, W. F. Dillon, H. B. Dillon and James F. T. Walker. The company will do a general electrical supply and machine business.

THE PELLISSIER ENGINEERING COMPANY, of Springfield, Mass., has been incorporated with a capital stock of $50,000, to carry on the business of civil and mechanical engineers and to deal in electrical machinery. L. D. Pellissier, of Holyoke, Mass., is president and George E. Pellissier, of Springfield, Mass., treasurer.

THE THOMPSON ELECTRIC COMPANY, of Raleigh, S. C., has been incorporated by D. J. Thompson, F. E. Thompson and others. The company has an authorized capital stock of $3,500 and intends to do an electrical contracting business.

THE WHITE ADDING MACHINE COMPANY, of East Orange, N. J., has been incorporated to manufacture adding machines and to conduct a mechanical and electrical engineering business. It is capitalized at $1,000,000, and the incorporators are C. O. Geyer, F. E. Ruggles and S. L. Gedney, Jr., all of East Orange.

THE WILSON-MALTMAN ELECTRIC COMPANY, of Baltimore, Md., has been incorporated with a capital stock of $50,000 to manufacture electrical appliances, etc. The officers are: William L. Wilson, president; Ralph C. Sharretts, 506 Continental Building, vice-president and manager, and J. Scott Maltman, treasurer, all of Baltimore.

## New Incorporations

BURBANK, CAL.—The Burbank El. Lt. & Pwr. Co. has been incorporated to conduct an electric light and power business at Burbank, Cal. It has an authorized capital stock of $20,000, and the directors are George H. Deacon, William Coryell, L. B. Coryell and H. M. Deacon, of Burbank, and F. A. Faust, of Glendale.

NASHVILLE, ILL.—The Washington County Long Distance Tele. Co. has been incorporated with a capital stock of $2,500 to conduct a telephone business. The incorporators are William H. May, William Merker and Henry Weilmuenster.

PEORIA, ILL.—Articles of incorporation have been filed by the Chicago, Peoria & Quincy Trac. Co., with a capital stock of $200,000. The company has proposed to construct an interurban railway from Quincy through Adams, Brown, Schuyler, Cass, McDonough, Fulton and Peoria Counties to a point in or near Peoria.

CANNELTON, IND.—The Cannelton Public Service Company has filed articles of incorporation with the Secretary of State. The capital stock is placed at $10,000, and the object of the corporation is to construct a power plant which will furnish light, heat and power to the city of Cannelton and adjacent communities. Among those interested are Lee Rodman, A. F. Hafele, M. F. Casper, J. T. Hay and G. W. Hufnagel.

CROWN POINT, IND.—Articles of incorporation have been filed by the Calumet El. Co. It is capitalized at $10,000 and plans to generate, distribute and sell electrical energy. R. L. Courtright is chairman of the board of directors.

## Trade Publications

CONCRETE BUILDINGS.—Bulletin No. 11 illustrates some of the latest work of the Turner Construction Company, 11 Broadway, New York, and shows the development of the concrete-building art.

EXHAUST STEAM.—A reprint from *Power* of an article by R. O. Warren, entitled "Confessions of an Engineer," has been issued as Bulletin No. 126 of the American District Steam Company, North Tonawanda, N. Y.

STREET LIGHTING.—Bulletin No. 4951 of the General Electric Company has for its subject series street lighting with tungsten lamps. Bulletin No. 4952 is devoted to the company's series incandescent street-lighting system.

COPPER-CLAD STEEL WIRE.—A report on copper-clad steel wire for municipal fire-alarm and police-signaling systems made by Mr. Frank F. Fowle, as consulting electrical engineer, has been issued in pamphlet form by the Duplex Metals Company, Chester, Pa.

INSULATION.—Bakelite insulation is the subject of a booklet issued by the Boonton Rubber Company, Boonton, N. J. This form of insulation requires no machining, the molded pieces of bakelite taking the place of machine-finished parts of hard rubber and fiber on electrical apparatus.

METALLIZED-CARBON-FILAMENT LAMPS.—The engineering department of the National Electric Lamp Association, Cleveland, Ohio, has recently issued Bulletin 3B, which covers the description and performance of metallized-filament lamps, with data on the cost of producing light with them.

WATT-HOUR METERS.—The Siemens Brothers Dynamo Works, of London, England, have recently distributed a new publication describing the Siemens type G5 watt-hour meter. The pamphlet is fully illustrated and shows in detail how various parts of the equipment may be renewed without replacing an entire meter.

INSULATORS.—Bulletin No. 28 B of the Fairmount Electric & Manufacturing Company, Philadelphia, Pa., deals with its 15,000-volt switchboard insulators which have been specially designed for high-voltage switchboard construction but are equally available for low-voltage work. Pot-heads and conduit fittings are illustrated on the back cover.

## Business Notes

FEDERAL SIGN SYSTEM.—Mr. F. H. Welling has been appointed Western district manager of the Federal Sign System (Electric) in charge of the Pacific Coast interests of that company, with headquarters at San Francisco.

WESTERN ELECTRIC COMPANY.—The annual conference of the "Sunbeam" lamp salesmen of the Western Electric Company was held during the week of July 29 at the Maplewood Beach Hotel, near Cleveland, Ohio, simultaneously with the conference of the "Brilliant" lamp salesmen. The men were addressed by members of the engineering department of the National Electric Lamp Association and by members of their own sales organizations on topics of commercial and technical interest. On Wednesday afternoon, July 31, there was a hair-raising ball game between the "Brilliant" and the "Sunbeam" salesmen, in which the latter came off victorious by a score of 8 to 1.

COLUMBUS MACHINE & TOOL COMPANY.—Contracts for the construction of a modern manufacturing plant in Columbus, Ohio, have been placed by the Columbus Machine & Tool Company, which was incorporated in June with a capital stock of $500,000. Since its incorporation, the new concern has purchased the business of the Columbus Machine Company, of Columbus, Ohio, and that of the Vulcan Furnace Company, of Warren, Ohio. Gas, gasoline and oil engines up to 600 hp, mechanical stokers, shaking grates, pipe machines, bolt machines and piston machines, etc., will be manufactured by the company. Orders for machine-tool and power equipment have not been placed yet. Pending completion of the new plant, manufacturing is being conducted in the plant of the Columbus Machine Company. D. H. Palmer is president and general manager of the company.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED AUG. 6, 1912.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,034,408. ELECTRIC MOTOR; E. M. Barnes, Hastings, Mich. App. filed June 17, 1911. For carpet sweepers, etc.

1,034,875. TELEPHONE SYSTEM; H. P. Clausen, Chicago, Ill. App. filed Feb. 21, 1902. Local battery substation and central energy exchange.

1,034,510. CIRCUIT-CLOSING DEVICE; A. D. Rizer, Elgin, Ill. App. filed Aug. 4, 1910. Automatic signal for trolley lines.

1,034,518. HANGER FOR ELECTRICAL APPARATUS; A. Scheible, Chicago, Ill. App. filed March 12, 1909. Insulating device.

1,034,584. LIGHTNING ARRESTER; F. S. Chapman, Kenton, Ohio. App. filed Nov. 16, 1906. Silent discharge in vacuum.

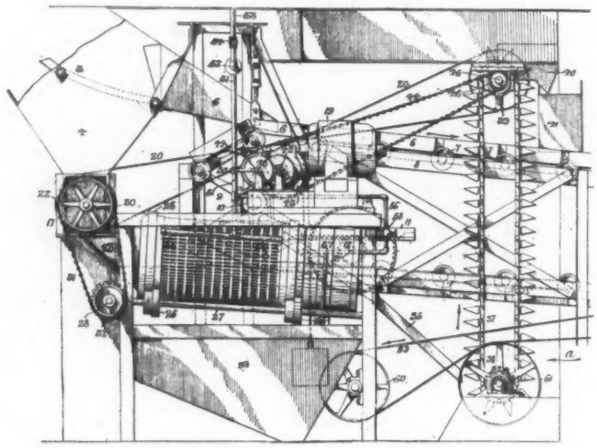
1,034,594. ARC LAMP; K. von Dreger, Berlin, Germany. App. filed Jan. 14, 1909. Plurality of pairs of horizontal electrodes.

1,034,596. ELECTRIC SWITCH; P. Druseidt, Remscheid, Germany. App. filed Dec. 30, 1911. Push-button-operated rotary snap type.

1,034,609. METHOD OF FAULT LOCATION ON ELECTRICAL CONDUCTORS; H. M. Friendly, Portland, Ore. App. filed May 13, 1907. Measurements are taken and the trouble is located by physical means without extended calculations.

1,034,620. ELECTRIC STENCIL-CUTTING MACHINE; E. A. Ivatts, Paris, France. App. filed March 16, 1910. For cutting stencil bands for coloring kinematographic films.

1,034,666. OVERFLOW ALARM; A. G. Weier, Chicago, Ill. App. filed Sept. 5, 1911. For water tanks.



1,034,969.—Apparatus for Separating Magnetic Metal from Sand.

1,034,668. APPARATUS FOR SEPARATING AND COLLECTING PARTICLES OF ONE SUBSTANCE SUSPENDED IN ANOTHER SUBSTANCE; A. G. Wright, Berkeley, Cal. App. filed Oct. 24, 1911. For separating water from petroleum, etc.

1,034,686. HEADLIGHT; F. Buchanan, Dayton, Ohio. App. filed Feb. 26, 1907. Feeding and supporting details; for trolley cars, etc.

1,034,689. THERMOSTAT; T. Chapman, Denver, Col. App. filed April 14, 1911. The thermostatic bar actuates only the circuit-closing device.

1,034,691. ELECTRIC IGNITER; J. G. Cook, Brooklyn, N. Y. App. filed Feb. 5, 1912. Automatically reeling cable and resistance.

1,034,537. ELECTRICAL SYSTEM OF DISTRIBUTION; W. A. Turbayne, Lancaster, Pa. App. filed Oct. 29, 1909. Car-lighting axle-driven generator.

1,034,561. ELECTRICAL DISTRIBUTION SYSTEM; V. G. Apple, Dayton, Ohio. App. filed April 23, 1906. A generator, storage and metering system with a unidirectional rotary switch.

1,034,572. ELECTRIC CONDUIT FITTING; C. H. Bissell and F. Smith, Syracuse, N. Y. App. filed Oct. 6, 1910. Switch support.

1,034,583. INDUCTION COIL; J. F. Cavanagh, Providence, R. I. App. filed April 19, 1909. Tight casing.

1,034,711. CONTAINER FOR METAL BOILER CLEANERS; F. A. Ives, New Haven, Conn. App. filed July 24, 1909. Wire helix with hooks.

1,034,719. ELECTRIC ELEVATOR-CONTROLLING APPARATUS; W. D. Lutz, Allendale, N. J. App. filed Jan. 6, 1906. Automatic means for cutting resistance in and out of an electromagnetic circuit.

1,034,722. INCANDESCENT LAMP; M. M. Merritt, Middleton, Mass. App. filed Feb. 24, 1906. Stem-fracturing means to prevent renewal.

1,034,747. ELECTRIC FURNACE; C. A. Weeks, Philadelphia, Pa. App. filed Oct. 23, 1909. Inclined tubular rotary-reducing flue for smelting copper, iron, etc.

1,034,760. MAST FOR RADIOTELEGRAPHY. F. G. F. Bräckerbohm, Wilhelmsruh, Germany. App. filed Feb. 14, 1912. Articulated.

1,034,784. METHOD OF PRODUCING REFINED METALS AND ALLOYS; A. E. Greene, Pueblo, Col. App. filed April 10, 1908. Electric-furnace iron smelting.

1,034,785. METHOD OF PRODUCING REFINED METALS AND ALLOYS; A. E. Greene, Pueblo, Col. App. filed July 22, 1908. Removing sulphur and phosphorus.

1,034,786. PROCESS OF REFINING ALLOY STEEL; A. E. Greene, Pueblo, Col. App. filed Jan. 6, 1909. Low-carbon manganese steel.

1,034,787. PROCESS OF REFINING METALS AND ALLOYS; A. E. Greene, Pueblo, Col. App. filed April 7, 1909. Elimination of sulphur and phosphorus from manganese steel, etc.

1,034,788. PROCESS OF EXTRACTING AND REFINING METALS AND ORES; A. E. Greene, Pueblo, Col. App. filed Dec. 6, 1909. Ore is treated with gaseous reagents under controlled heat.

1,034,791. VENDING APPARATUS; C. Hänel, Südende, Germany. App. filed April 18, 1911. Motor-driven ticket printing and vending.

1,034,797. NEGATIVE-POLE PLATE; G. M. Howard, Philadelphia, Pa. App. filed Feb. 17, 1908. Pockets for the active material.

1,034,798. HEAT-INDICATING DEVICE; W. B. Hughes, Newark, N. J. App. filed March 9, 1910. Diaphragm thermostat.

1,034,810. DISK STOVE; C. P. Madsen, Chicago, Ill. App. filed Feb. 6, 1911. Thin plate with spiral resistance.

1,034,859. HAIR COMB; G. Anderson, New York, N. Y. App. filed Sept. 11, 1911. Heating elements in the teeth.

1,034,883. LIGHTNING ARRESTER; E. E. F. Creighton, Schenectady, N. Y. App. filed Aug. 3, 1908. Aluminum electrode type for street-railway systems, etc.

1,034,887. PROCESS FOR REGENERATING STORAGE-BATTERY PLATES; M. Deinlein, Munich, Germany. App. filed Oct. 25, 1911. The negative plates are short-circuited with a zinc member.

1,034,888. SECTION INSULATOR FOR OVERHEAD STRUCTURES; F. S. Denneen and G. A. Mead, Mansfield, Ohio. App. filed Feb. 26, 1909. For catenary messenger and trolley wires.

1,034,890. COOLING MEANS FOR DYNAMO-ELECTRIC MACHINES; W. A. Dick, Pittsburgh, Pa. App. filed Aug. 8, 1908. Duplex machines with fan blower.

1,034,909. ELECTRIC CONDUIT FITTING; B. M. Graybill, Chicago, Ill. App. filed May 4, 1909. Draw-in box.

1,034,910. PLUG CONNECTOR; W. R. Greenway, Brooklyn, N. Y. App. filed May 5, 1911. Separable shell.

1,034,917. MEANS FOR CONSTRUCTING INCANDESCENT LAMPS; A. S. Knight, Newark, N. J. App. filed May 13, 1909. Adjustable support and guide.

1,034,923. VACUUM-TUBE LAMP; D. McF. Moore, Newark, N. J. App. filed Nov. 26, 1904. Vacuum lamp with a non-volatile compound of CH and O.

1,034,924. REGULATOR FOR DYNAMO MACHINES AND ELECTRIC CIRCUITS; R. M. Newbold, Chicago, Ill. App. filed July 2, 1906. Axle-generator railway lighting.

1,034,929. ELECTRICAL APPARATUS; A. B. Reynders and J. E. Mateer, Wilkinsburg, Pa. App. filed May 13, 1909. Insulation of the coils and leads of transformers.

1,034,934. TRANSFORMER; O. Schaumberg, Pittsburgh, Pa. App. filed July 6, 1908. Clamping and anchoring a laminated core.

1,034,945. ELECTRICAL MEASURING INSTRUMENT; J. L. Zander, Irvington, N. J. App. filed Sept. 28, 1910. Galvanometer.

1,034,949. PRODUCING METAL FILAMENTS; W. C. Arsem, Schenectady, N. Y. App. filed May 9, 1909. Copper is driven off from an alloy with molybdenum.

1,034,952. WATER HEATER; H. P. Ball, Pittsfield, Mass. App. filed May 17, 1911. Thermal insulation and circulation.

1,034,964. MAGNETO BELL RINGER; E. Bowman, Elmwood, Ontario, Canada. App. filed April 18, 1912. Spring-supported armature.

1,034,969. APPARATUS FOR SEPARATING MAGNETIC METAL FROM SAND; J. W. Brown, Jr., Philadelphia, Pa. App. filed May 6, 1910. Molding art.

1,035,009. SYSTEM FOR ELECTRICALLY TRANSMITTING SIGNALS; E. Hermsdorf, Brunswick, Germany. App. filed Oct. 10, 1911. Connections are made over a spark-gap.

1,035,020. GROUND ROD; C. Lanz, Pittsburgh, Pa. App. filed March 11, 1911. Wire clamped by integral collar on rod.

1,035,042. ELECTRIC HEATER; F. C. Perkins and M. M. Buck, Franklinville, N. Y. App. filed Dec. 1, 1910. Coin-operated curling irons.

1,035,045. SYSTEM OF SUSPENSION; P. Pforr, Berlin, Germany. App. filed March 13, 1907. Double catenary

1,035,060. ELECTROLYTIC CELL; A. Tommasini, New York, N. Y. App. filed March 21, 1912. For decomposing water.

1,035,069. TRANSFORMER; C. Aalborn, Wilkinsburg, Pa., and O. Schaumberg, Pittsburgh, Pa. App. filed July 6, 1908. Core-section supports.

1,035,119. FLAMING-ARC ELECTRODE; E. J. Guay, Lynn, Mass. App. filed Aug. 10, 1910. Titanium carbide, calcium fluoride, cryolite and carbon.

1,034,405. PRINTING TELEGRAPH; B. Soldatencow, Paris, France. App. filed Feb. 5, 1912. Electromagnetic device with two distinct actions.